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CHARLES W. PRICE,
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THE BOSTON ELEVATED RAILWAY.

It is entirely proper to regard the new electrically equipped railway system which has just been put into service in Boston as the best piece of work in this line, done up to date. Of peculiar and special interest is the multiple unit system employed for the equipment of the trains.

Attention is called to the article describing this installation, which will be found on other pages of this issue. The work, while conducted under conditions of peculiar difficulty, is typical of the best variety of American construction work, and it is believed that in the operation of the system excellent results will be achieved, both from the engineering and financial point of view.

CONSERVATISM.

The accusation of conservatism has not long been a fair charge to lay at the door of American engineering methods. As we grow older, however, and, in the engineering arts, as the period of rapid exploitation and development is passed and succeeded by that of widespread application of similar and perfected methods, we are developing rapidly the conservatism that seems to be an inherent quality of our race. While a little of this element is unquestionably a sort of safeguard, to discover the effects of too much of it we need only to look at the situation of British industries, whose condition of paralysis to-day is practically due to the overwhelming influence of tradition, affecting the conduct of all manners of business in that country.

It is the force of conservative tradition that is to-day responsible for the hand brake on street cars, for the obsolete methods of applying electric light which are practically universal, and, as Mr. H. G. Wells has pointed out lately in a thoughtful article in the *Fortnightly Review,* is also responsible for the scale of operation of our railways, seeing that this was determined by the magnitude of the wagons in use when railways were first introduced. We still have the four-foot-eight-and-one-half-inch gauge as the standard, for the reason that this was the standard gauge of wagon wheels a century ago. The consequence is that our transportation facilities are crowded and narrowed by the dimensions of vehicles built upon a unit of measure suggestive rather of the horse than of the locomotive. It is to be hoped, though hardly to be believed, that the railroad of the future, when it comes to undertake the construction of entirely new equipment, will possibly see the advantages to follow a wider gauge combined with electrical operation.

Let us take a hypothetical case and suppose a railroad running from the great coal and iron centres of production in western Pennsylvania to deep water on the Atlantic seaboard. Suppose such a railroad should be built of, say, ten-foot gauge, with car equipment to match, with bridges, tunnels, etc., all magnified on the same linear scale. Such a railroad could handle bulk freight at figures the economy of which would absolutely astound the average railroad man. Its transportation units would be very large, since cars could easily be constructed capable of carrying four hundred tons each of such freights as coal or ore or wheat. Passenger cars could be built on much the same scale of dimensions as steamboats are to-day, giving the passengers real comfort and also plenty of room for sufficient and comfortable accessories of travel which are now denied those who journey by rail.

There is a sort of unwritten rule in railroad work which connects the width of the gauge with the safe speed that may be made on any railway. Applying this to a track of ten-foot gauge it is indicated that speeds of about 125 miles an hour would not be excessive on such a track. Couple all this with the advantages of electric traction for railways and some faint conception may be had of the possible railroad of the future. Whether or not we will ever see a magnified railroad of this character depends entirely upon conditions which can not at this time be foreseen. A single line of railroad built on this generous scale would have an enormous capacity for handling freight, and, naturally, would have to have a very great output at one end and demand at the other to keep it busy. It could not exchange cars with any other line and there would be numerous other practical objections to any alteration in the gauge that has become standard. The heavy burden of conservatism, of which the railroad furnishes a typical example, should make us a little bolder in designing improvements and lead us more often to examine

all the possible solutions of a given problem instead of seizing upon the one which is nearest to current practice.

FREE ENGINEERING.

If a man is sick or if he needs legal advice he goes to the doctor or the lawyer, and no matter how intimate his personal relations with them may be he expects to get a bill for their services; he takes the payment for their skill and attention quite as a matter of course.

The chances are that if the same man happens to know an electrical engineer he will go and ask him all sorts of minor questions requiring considerable study for their proper answer, make requests for all manners of information, some of which have been obtained perhaps at considerable expense, and would be utterly horrified if he received a bill. And the strangest part about it is that nine engineers out of ten cheerfully render these services to their friends, or even their acquaintances, without the slightest thought of charging for them.

This state of things is inequitable and ought not to continue. An electrical engineer is a professional man by reason of study and of a costly education, in precisely the same degree as is the physician or the lawyer. His right to trade on his information, experience, knowledge, skill and trained judgment in matters having to do with electricity is perfectly similar to that of other practitioners of the arts and sciences, and no reason can be observed why his right to charge a fee is not equal in all respect to theirs. There has been entirely too much free consultation and free advice given in this country. It may not be improper though to call the attention of our lay friends who read this to the fact that free advice is not the most valuable kind. The whole question of charges for service ought to be made the subject of a discussion, say at the American Institute of Electrical Engineers' annual meeting, and some standard practice should be put in vogue that would stop the objectionable habit of free advice-giving, and doubtless increase to some degree the income of many engineers. It would also give, undoubtedly, a greater value both in actuality and in estimation to electrical engineering opinions.

WIRELESS TELEGRAPHY.

In the paper by Mr. G. Marconi on "Syntonic Wireless Telegraphy," and the discussion following it, which is concluded in this number, there is food for a vast deal of thought and speculation.

Assuming that Mr. Marconi and the others who are working along the same line have produced a reliable syntonic system capable of operation in all weathers up to a reasonable radius of, say, one hundred miles and certain in its work, they have conferred a benefit of the first class upon their generation. But like many other benefits it may not be appreciated until too late for the appreciation to inure practically to the benefit of those who deserve it.

Of what vast benefit the new art can be to navigation and as an insurance of safety to life and property afloat there is no need for argument. It is just what has been wanted for the untold centuries since the first seafaring man saw the horizon blank and landless about him. We have had wireless telegraphy in fairly workable form for two or three years, yet it is only lately that the great corporations controlling the Atlantic ferry have begun to interest themselves to the feeble extent exhibited by the making of a few experiments.

The results attained during the last two years by wireless telegraphy leave no room for doubt that, in so far as a satisfactory system of signaling between ships at sea is desired, and for purposes of signaling through fogs from lighthouses or other fixed points on the coasts to vessels in the offing, the new art is practically and thoroughly worked out. If, therefore, the rates at which the apparatus and the rights to use it may be had from the various inventors involved are not prohibitive, there can be no excuse for failure to equip all vessels carrying passengers and the lighthouses of civilized coasts.

It is sincerely to be hoped that the immense advantages that will accrue to the world's commerce and to the safety of life at sea, and which are really assured by the successful working of this system, will not be interfered with by any short-sighted policy on the part of the business management of its exploitation. One very important utility which was discovered a quarter of a century ago brought its owners large sums and has proven of inestimable benefit to the public, but at the same time it has been felt that a more liberal policy would have made its use more general and have paid even larger earnings to its owners. It is to be hoped that the history of the telephone will not be repeated in the case of wireless telegraphy.

THE TELEPHONE AS A CITY FIRE ALARM.

Kansas City, Mo., does not maintain a city fire-alarm system, but the fire department depends entirely upon the telephone for alarms of fire. Statistics show that Kansas City has been remarkably free from destructive fires. The chief of the fire department gives the credit for the efficiency of his department to the promptness and correctness with which the alarms and exact location of fires are transmitted to the fire department by means of the telephone. Every telephone is a recognized fire-alarm signal. This company—the Missouri & Kansas Telephone Company—also maintains for the city a police signal system, and police headquarters may be promptly reached at any hour from any subscriber's telephone in the Kansas City exchange. These fire and police connections widen the scope of the telephone, particularly for residence purposes, and they are of special advantage to residence subscribers.

With the next issue of the ELECTRICAL REVIEW the important serial by Professor W. E. Goldsborough, treating of alternating-current phenomena, will take up the subject of polyphase circuits. This, as is well known, is the most important direction of the application of alternating currents, and its treatment by the felicitous methods applied to single-phase currents in Professor Goldsborough's former articles will doubtless prove of interest as well as of value.

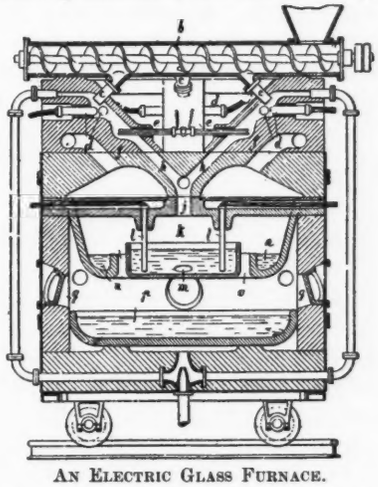
In Cuba the telephone has shown remarkable popularity since political conditions in that island have become more tranquil and business has been resumed. In Havana it seems destined to achieve the same remarkable record it has made in Mexico, both the climate and the national temperament being such as to encourage its widespread use.

Science Brevities

Velocity of Ions—Some short time ago there appeared an article by Mr. C. D. Child offering an explanation of the electric arc on the assumption that the current in the arc is carried by ions. In another article on the subject Mr. Child refers to a method of investigating the arc further, says the London *Electrical Engineer.* The experiments carried out by the author may be summarized as follows: A study of the rate of discharge from an arc to a neighboring body showed that under varying conditions of difference of potential, distance and current in the arc itself, the positive ions drawn from the arc moved more rapidly than the negative ones. This is not to be explained as an effect due to ultra-violet light or any phenomena previously studied. The positive ions from a carbon placed in an oxy-hydrogen flame also moved the more rapidly. In cases of an arc between metals the negative ions again moved rapidly. While this work did not prove that the positive ions in the arc itself moved more rapidly than the negative ones there, it is in every respect consistent with such a hypothesis, and it shows that it is possible for the positive ions to do so. The question why the positive ions here showed this peculiarity is, of course, entirely unanswered. In all the cases so far studied we have had carbon, and also a very high temperature. It would at present be useless, the author concludes, to speculate as to whether this phenomenon is to be ascribed to one or the other of these facts, or to some one entirely different. In time the author hopes to publish further experiments bearing on this point.

Electro-Motive Force of Clark Cells—Professor Henry Carhart, in some recent publications, has discussed at length the various determinations of the electro-motive force of the Clark cell. The value originally obtained by Clark reduced to present units at 15 degrees centigrade is 1.4378 volts, but subsequent research has shown that this is somewhat too high. Professor Carhart summarizes the results of eight other determinations of this constant, in five of which the value was obtained by the use of the silver voltameter, the remaining three values being obtained by absolute methods. The mean value calculated from the whole eight determinations is 1.4335 volts at 15 degrees centigrade, and the mean of the three absolute determinations is 1.4333 volts. Professor Carhart concludes that the true value is nearer 1.433 volts than the generally accepted value of 1.434 volts. This conclusion is borne out by the result of two determinations of the mechanical equivalent of heat by electrical methods, in both of which the values obtained are higher than those given by direct mechanical methods; if the electro-motive force of the Clark cell is taken as 1.433 volts instead of 1.434, the discrepancies almost disappear.

Electric Glass Furnace—A British patent was recently granted August Voelker, of Cologne, Germany, for an electric furnace for the production of glass. The accompanying illustration is taken from the patent specifications, and shows the operation of the furnace. The materials for forming the glass are fed by the conveyor, *b*, through four tubes into inclined radial passages, *h*, wherein they are melted by the electric arc produced by the electrodes, *d*, and Jablochkoff candles, *e*. The molten materials flowing down the passages, *h* and *j*, enter the refining pot, *k*, wherein, when fine glass is to be produced, refining is effected by the heat caused by resistance between two electrodes, *l*. The fluid gas flows from the pot, *k*, through opening, *m*, into the annular trough, *n*, whence it overflows through passages, *o*, into the basin, *p*, from which it is worked by tools inserted through the doors, *q*.



AN ELECTRIC GLASS FURNACE.

Coherers for Wireless Telegraphy—Writing in our British contemporary, the *Physical Review,* Mr. Carl Kinsley discusses the sensitiveness of coherers for wireless telegraphy and urges the desirability of some standard method of comparing coherers so that the work of different experimenters may be compared, and suggests two ways in which this may be done. Coherers may either be compared relatively by measuring the height of vertical wire necessary for them to respond to signals sent by a given transmitting apparatus at a given distance, or, absolutely, by measuring the voltage at which their initial resistance breaks down. The two methods, it is pointed out, always give the same relative results; the latter appears to be preferable as it is more easily carried out, and, moreover, eliminates all errors which might arise through differences in the transmitters, which is especially advantageous in the case in which the work of different persons is being compared. Mr. Kinsley insists that the absolute value of the resistance after the breakdown, whether high or low, is not of much importance, as the relay can always be designed to work well with the particular coherer with which it is intended to use it.

Chloroform and Iodoform by Electrolysis—In a recent article in the *Electro-Chemist and Metallurgist,* of London, occurs an interesting statement regarding the electrolytic production of chloroform and iodoform. The close analogy in composition between these two bodies, which may be regarded as marsh gas in which three atoms of hydrogen are replaced in the one case by three of chlorine and in the other by three of iodine, would lead one to suppose that the electrolytic methods of preparing them would show the same connection as the compounds themselves. This is true in the laboratory to a large extent, but is by no means true as regards the commercial manufacture of the haliods. The success which attended the electrolytic manufacture of iodoform under Schering's German patent has stimulated investigators to attempt the manufacture of chloroform in a similar manner. Dorry-Henault has, however, given theoretical reasons why neither chloroform nor bromoform can be so prepared commercially. Iodoform is produced by the action of hypoiodous acid upon alcohol in an alkaline solution and not by the action of free iodine. This change in procedure, which the cheapening of electric current production has brought within the sphere of manufactures, gives a yield from 20 to 40 per cent greater than that attainable by the old processes. The equation representing the reaction between alcohol and hypoiodous acid is:

$$C_2H_6O+5HIO=CO_2+CHI_3+2HI+4H_2O$$

In practice, however, some of the hypoiodous acid is apt to break up into hydric iodide and iodate, so that only a comparatively small fraction of it reacts with the alcohol. This, however, can be, to a large extent, prevented by the addition of iodide or iodate of potassium. Two processes are in use. One consists in electrolyzing a

mixture of five pounds of potassium iodide, three pounds of alcohol and fifty pounds of water, while a continual current of carbonic acid is passing through it. The iodoform precipitates, and can be obtained in powder or in largish crystals by varying the strength of the electrolyte. Another consists in having a cell divided by a porous partition, on one side of which is a platinum anode immersed in a solution of five pounds of potassium iodide, ten of sodium carbonate and eight of alcohol, in ten gallons of water. The cathode is a nickel netting immersed in strong soda-lye on the other side of the partition. Here it will be seen that the carbonic acid is brought into contact with the other ingredients in a combined instead of in a free state. The process gives for its chief secondary product iodide of sodium. It is worked hot (at about 70 degrees centigrade) at a current density of about one ampere to the square decimetre. After about three hours the current is stopped, and the electrolyte allowed to stand for the iodoform to settle. Only one good process for the electrolytic preparation of chloroform is known. It consists in passing a current through brine, and after a certain time running in a continuous stream of acetone, much as alcohol is run into sulphuric acid in the manufacture of ether. The acetone reacts with the chlorine produced by the current, forming trichloracetone, which then, in its turn, reacts with the caustic soda present, according to the equation:

$$C_3H_3Cl_3O+NaHO=NaC_2H_3O_2+CHCl_3$$

It will be observed that the chief subsidiary product is sodium acetate, a salt of considerable commercial importance. The electrolysis is carried out in a still, so that the chloroform can be got out of the way of secondary reactions as it is produced.

The Photographophone—Herr E. Ruhmer has considerably improved his photographophone, and achieved some very notable successes with it. An *Electrician* abstract says: The vibrating flame of an arc lamp is photographed on a kinematograph film, and the sound vibrations are thus translated into dark and bright stripes on the film. The light is concentrated upon the sensitive film by means of a cylindrical lens. When the impression of the voice has thus been taken the film is developed and fixed in the usual way. To reproduce the sound the filament is moved past an ordinary projection lamp, and a sensitive selenium cell provided with telephones and a dry battery is placed behind it. The changes in the illumination of the selenium cell produce changes in the current corresponding to the original sound vibrations. The velocity of the film is two or three metres per second, but even with 20 centimetres per second good results are obtained. From one negative any number of positive films may be obtained, and either the negatives or positives may be used for reproduction. The inventor hopes to record pictures and sounds on the same film. An interesting development proposed is the synthesis of human speech from its elements, obtained from the photophonograms, or from an artificial film suitably shaded.

Commercial Electrolysis of Water—W. Dürer, in the *Elektrotechnische Zeitschrift,* states that to keep the gases separate metallic septa act satisfactorily without introducing resistance like an ordinary porous diaphragm. The products are not set free on the surfaces of the metallic septum, but only at the electrodes, provided the difference of potential is kept within moderate limits. One of the principal applications is the preparation of hydrogen for balloons, for which purpose the gas is required as pure as possible. Its purity is tested by a diffusion apparatus in which the gas passes through a fine orifice under known pressure, and the rate of passage is automatically recorded by an electrical arrangement. It is also regulated by passing it over warm platinum sponge, which causes an explosion when oxygen is present in any quantity. The yield of hydrogen by this process is 0.12 cubic metre per horse-power-hour, says *Lightning.* The mixed gases are largely used for the autogenous soldering of accumulators, and also for aluminum; they give a powerful illumination with a suitable mantle, and have been applied for heating glass furnaces.

Osmium Lamps—Some experiments have recently been carried out in order to test the relative efficiency of osmium lamps with ordinary carbon lamps. In one test, says an English contemporary, four 25-volt osmium lamps in series and four 100-volt carbon lamps in parallel were arranged on a 100-volt circuit, and both gave the same illuminating power, but the osmium lamps consumed only 40 per cent of the current required for the ordinary lamp. In another test an osmium lamp consuming energy equal to 24 watts gave a light of 20 candle-power, while a carbon lamp with the same consumption gave a light of only six candle-power. Osmium lamps can be made to give a light of from 100 to 200 candles, and lamps that have become darkened can be restored without renewing either the bulb or the filament. The supply of osmium is becoming rather limited, and the question still remains as to how far the price of the metal is prohibitive.

Smelting Iron by Electricity—Very few attempts have been made on a practical scale at the electric reduction of iron from its ores, since the low value of the metal leaves only a small margin for expense of extraction. A furnace of 500 horse-power was, however, installed at Brescia for the production of iron, steel and other metals direct from their ores, by a process invented by Captain Stassano, of Rome. The experiments were conducted before a commission composed of Signors Arno, of the Milo Polytechnic; Del Lungo, of the Institute of Spezia, and Engineer Siracusa, director-general of the Italian Electric Company, Turin, but the results have not yet been made public.

Commercial Outlook for the United States in Paraguay.

Concerning the commercial outlook in Paraguay, Mr. John N. Ruffin, consul at Asuncion, writes, under date of April 27, 1901, as follows:

"The trade of Paraguay with the United States is increasing, and the prospects are that before the expiration of the present year it will have reached an unprecedented volume. For instance, the firm of Angulo y Cia. has devoted considerable space to an exhibition of United States goods, in which, I am informed, it is doing a large and ever-increasing business, especially in agricultural implements. It expects to make many sales of carriages, *electrical supplies,* bicycles, dry paints and other articles of United States manufacture.

"A contract has been made with a large landowner here for the establishment of a quebracho factory, for the production of extract of quebracho for use in tanneries. Another plant (known as 'curupay'), I am informed, gives even more tannic substance than the quebracho—the yield being as high as 36 per cent—and, in my opinion, a factory for its utilization would prove an excellent investment. As yet, the scheme has never been tried.

"The engineers who have been considering the establishment of waterworks for the city of Asuncion will shortly submit to the authorities the results of their observations, when the government will call for bids. The works will be quite extensive and will involve the use of considerable quantities of piping and iron material. In addition to the waterworks, the government will, in the near future, take up the matter of road building and the dredging of the pass at Angostura."

THE THEORY OF ALTERNATING DYNAMO ELECTRIC MECHANISMS—XXXII.

BY W. ELWELL GOLDSBOROUGH.

It will further be noticed that there are two points at which the branch and line currents are in phase. One of these is when the circuit O′A′ is open. At this time $I_2' =$ zero, and by Fig. 86, OB^a is in phase with $OB_{2_{//}}{}^a$; also, when the reactance of the circuit O′A′ is zero, the line and branch currents are in phase. At this time $OB_{2_{/}}{}^d$ and $OB_{2_{//}}{}^d$ are in phase with OB^d.

The diagrams of Fig. 85 and Fig. 86 differ markedly in several points. In the first place in Fig. 85 the line currents represented by OB^a and OB^d are shown in phase, whereas, in Fig. 86, they are separated by the angle B^aOB^a. This change is, of course, brought about by the generator electro-motive forces of the two vector diagrams of which they form a part, being drawn together, since the transfer of the vectors from Fig. 85 to Fig. 86 does not alter the phase relations of the currents relatively to the generator electro-motive force.

In Fig. 86 the change of phase in the line current relatively to the generator electro-motive force is quite clearly brought out. The maximum angle of lag which the current can have behind E is that shown by the angle AOC_m, and the minimum phase displacement of the current behind E is shown by the angle AOC_n. Between these limits the variations of the reactance in the circuit O′A′ causes corresponding movements in the phase position of the line current between the maximum and minimum limits. Fig. 86 brings out also some very pertinent facts regarding the relative rate of change in the values of the receiver electro-motive force and the currents. For instance, while the receiver electro-motive force is passing between the points A_1' and $A_1{}^a$, the main line current is passing over the arc $B'B^a$, consequently, during the period of these movements the rate of change of the receiver electro-motive force is small, whereas the rate of change in the line current is relatively high. On the other hand, the receiver electro-motive force passes from $A_1{}^a$ to $A_1{}^e$, while the line current passes from B^d to B^e. In this case the conditions are reversed and the receiver electro-motive force is subjected to the greatest rate of change in value. These differences are brought about by the fact that the locus circle of the receiver electro-motive force is considerably rotated relatively to the current locus circle. In the latter the initial point B^a is quite near the point O, whereas in the former the initial point $A_1{}^a$ is removed from O, beyond the distance which a proportional relation with OB^a would give it, by an amount very nearly equal to the diameter of the receiver electro-motive force locus circle.

In Fig. 85 the generator electro-motive-force locus circle has substantially the same position as the current locus circle, insofar as the relative location of like points is concerned. During the transformation, however, from Fig. 85 to Fig. 86, a change in the relative position of the points on the circle about which the line electro-motive-force vector moves brings about quite a rotation in the relative location of like lettered points.

To further elucidate the bearing of a variable reactance in parallel circuits upon the regulation at the receiver terminals the rectangular coordinate curves of Fig. 87 are drawn. They show the relative values of the receiver electro-motive force, the line current and the angle of phase difference between the line current and the generator electro-motive force, plotted relatively to the current flowing in the reactive receiver circuit. The full sides of each of the three loops represent the conditions when the inductance reactance of the circuit O′A′ is changed from infinity to zero. At this time the current in the circuit O′A′ is growing; and, consequently, as indicated by the arrows, the curves grow out to the right. The dotted portions of the three loops show the conditions when the capacity reactance of the circuit O′A′ is changed from infinity to zero. At this time, of course, the current in the circuit O′A′ is diminishing in value; and, consequently, as indicated by the arrows, the curves are retrogressing to the left. From these curves, then, we gather the following facts: That, with a variable inductance in the receiver circuit O′A′, the electro-motive force at the terminals of the receiver circuit falls off rapidly and the angle of lag of the line current behind the generator electro-motive force is relatively large; whereas, on the other hand, when capacity reactance is present in the receiver circuit, the potential regulation at the terminals of the receiver circuit is more nearly constant and the line current comes quite nearly in phase with the generator electro-motive force.

Should it be desired to treat such a system as this mathematically the same line of development must be followed as that which is presented on page 572. Since, in the present instance, x_2' is a variable and r_2'' a constant, g_2' and b_2' are variables, and g_2'' a constant. Necessarily, then, since equation (190) expresses the variations that occur between the generator electro-motive force and the line current under these general conditions, it applies here, but it has to be interpreted in the light of the special limitations pertaining to the present case. Of course when x_2' has a zero value equation (190) admits of the modification shown in equation (191),

$$I = \frac{E}{\sqrt{\left(r_1 + \frac{1}{\frac{1}{r_2'} + \frac{1}{r_2''}}\right)^2 + (x_1)^2}} = \frac{E}{\sqrt{\left(r_1 + \frac{r_2' r_2''}{r_2' + r_2''}\right)^2 + (x_1)^2}} \qquad (191)$$

since, at this time, $g_2' = \frac{1}{r_2'}$ and $b_2' =$ zero. Although all the vectors shown in Fig. 86 can be readily evaluated by a proper use and interpretation of equation (190), the results, without the graphical treatment to assist in their illumination, do not present to the mind an adequate conception of the variations which actually occur in the system. For this reason, in this case, as in most others, the graphical treatment is desirable. It is clearer, as accurate and more rapid than the mathematical treatment.

Example 18.

Given: A distributing system, such as that shown in Figs. 83 and 84, in which an alternator developing a pressure of 130 volts at 60 cycles is impressed upon a receiving circuit through a distributing line. The resistance of the line is 0.6 ohm, and it has a reactance of one ohm. Primarily the receiving circuit consists of a non-inductive bank of incandescent lamps having a resistance of 2.5 ohms. In parallel with this system, however, is connected a second receiver circuit having a constant resistance of two ohms, and it is so connected through induction coils and condensers that its reactance may be made anything from negative to positive infinity. The internal resistance and reactance of the generator armature are small and may be neglected.

Determine what voltage values will appear at the terminals of the receiver circuit when the reactance of the reactive branch circuit is varied. Further, determine the lag of the line current behind the generator electro-motive force for each value of the reactance assumed. Finally, construct the polar vector diagram illustrating the phenomena due to the reactance variations, and by means of rectangular coordinates develop the

electro-motive force characteristic of the receiver under the conditions imposed.

In solving this problem graphically we will lay out a diagram such as that shown in Fig. 85. First make the vector OA_1, for temporary purposes, equal to 100 volts. Now, laying off OB^a equal in length to 40 amperes (which is the current the lamp circuit would take under this pressure) we can proceed and construct the line impedance vector diagram which the current OB^a brings into being. Then, in accordance with the outline already developed, we can lay off the vector $OB_{2_i}{}^d$ equal to five amperes, equal to the current that will flow in the reactive branch circuit when its reactance is passing through the zero value. Further, on $OB_{2_i}{}^d$ as a diameter, we can describe the locus circle of the current flowing in this branch circuit, and then (since, under present conditions, OB^a is a constant, and the line current is, at all times, the resultant of the two branch currents) we can draw the line current locus circle in the position indicated. If, now, different receiver currents are assumed, such as $OB_{2_i}{}^b$ and $OB_{2_i}{}^c$, the resulting line currents, OB^b and OB^c, are immediately determinable, since the distances $B_{2_i}{}^bB^b$ and $B_{2_i}{}^cB^c$ must be equal to the constant value of OB^a.

To find the line electro-motive force required to set up the line currents through the line impedance we transfer the vector OA_{2_i}, which is the initial value the line electro-motive force will have when the line current is equal to OB^a, to the position A_1A^a; then, upon the vectors of the assumed currents in the reactive circuit, we construct electro-motive-force triangles, such as OC_bA_b and OC_cA_c, the hypotenuses of which are equal to the line electro-motive forces required to force the reactive branch receiver currents through the line. Now, transferring these line electro-motive forces to positions in which they make, with A_1A^a, correct phase angles, we have determined the several values which the line electro-motive force must have in order to set up the several line currents. This construction is shown in the case of the two current vectors mentioned by the vectors A_1A^a and A^aA^b, which give the resultant line electro-motive force A_1A^b; and the vectors A_1A^a, A^aA^c, which give the line electro-motive force A_1A^c, the latter conforms to the line current OB^c and the former to the line current OB^b.

With the vector diagram completed we can scale it and obtain therefrom data for the final solution of the problem. Such data is tabulated in Table 11. This data shows that the generator electro-motive force, to maintain an electro-motive force of 100 volts at the receiver terminals, has to be varied between the limits of 130 and 178 volts. During this variation of the generator electro-motive force the line current varies from 40 to 90 amperes, the current in the reactance receiver circuit varies from zero to 50 amperes, and the current in the non-reactive receiver circuit remains constant at 40 amperes.

To determine what conditions will exist in the system with a constant electro-motive force of 130 volts maintained at the generator terminals the values given in Table 11 must be modified in the ratio of 130 to the values of the generator electro-motive forces recorded. Such a reduction gives the values tabulated in Table 12, and if the latter values are used in the construction of both polar and rectangular diagrams the solution of the example is complete.

Carrying out this line of procedure Figs. 86 and 87 are developed. The relation between the vectors shown in Fig. 86 and the values given in Table 12 is indicated by the exponent letters, by which it is possible to rapidly follow through the construction. For instance, OA = the constant generator electro-motive force = 130 volts. $AA_1{}^a$ = the initial line drop = 47 volts. $OA_1{}^a$ = the initial receiver electro-motive force = 100 volts. OB^a = the initial line current = 40 amperes.

In another case, when the reactance of the receiver circuit has been given a value of 1.36 ohms, the line current assumes the position OB^c, and has a value 57 amperes. The line electro-motive force has the position $A_1{}^cA = 66$ volts, while the receiver electro-motive force has the position $OA_1{}^c = 73$ volts.

The angle of lag of the line current behind the generator electro-motive force is determined directly from the values of E_r and E_x given in Table 11, since

$$\tan \phi = E_x \div E_r.$$

Therefore, we find that the angle of lag varies all the way from 10 to 37 degrees. The value of 37 degrees occurs when the reactive receiver circuit is inductive, while the low value of the angle of lag occurs when in the reactive receiver circuit capacity predominates.

In Fig. 87 a still further insight into the relative values of the quantities involved is possible, as the marginal figures show clearly the exact magnitude of the forces plotted.

Many examples following the outline of the one just considered can be profitably formulated and solved by the student. Such a procedure will bring out in marked contrast the bearing of resistance and reactance upon the regulation in transmission systems. In the present case the problem relates particularly to conditions in which variable motor loads are brought to bear upon illuminating circuits, and the general character of the voltage disturbances that may be expected are pointed out accordingly.

TABLE 11.

DATA PERTAINING TO EXAMPLE 18.

	E_2.	x_2'.	I_2'.	I	E_1.	E.	F_r.	E_x.	ϕ.
a	100	∞	0	40	47	130	124	400	18°
b	100	4.73	19	51	59	151	125	860	35°
c	100	1.36	41	78	90	178	142	1,070	37°
d	100	0	50	90	105	178	154	900	30°
e	100	1.30	42	79	91	151	143	490	19°
f	100	2.92	2.9	61	70	131	129	220	10°
a	100	∞	0	40	47	130	124	400	18°

TABLE 12.

DATA PERTAINING TO EXAMPLE 18.

	E.	E_1.	E_2.	E_r.	E_x.	I.	I_2'.	I_2''.	ϕ_2'.
a	130	47	100	124	40	40	0	40	90°
b	130	51	86	107	74	61	29	40	55°
c	130	66	73	104	78	68	36	34	38°
d	130	77	73	113	66	86	37	29	0
e	130	78	86	123	42	57	30	29	34°
f	130	70	99	129	22	44	17	34	68°
a	130	47	100	124	40	40	0	40	90°

Radium.

At a recent meeting of the Paris Society of Civil Engineers, M. P. Besson gave some particulars of the commercial production of radium, which has been undertaken by the Société Centrale de Produits Chimiques. Only about one-half ounce of the body can be obtained from one ton of the uranium minerals, which form the raw material, and the separation of this one-half ounce requires the expenditure of about six tons of chemicals, while 50 tons of water are used for washing purposes. M. Besson states that the activity of radium is such that it is spontaneously luminous in the dark. This luminescence does not arise like that of phosphorus from oxidization of the body, but is due to a continuous emission of electrified particles. The charge carried by these particles is enormous, but their mass is so small that the loss of weight is only about one milligramme in 100,000,000 years.

Electric Mail Carriers.

A committee appointed by Postmaster-General Smith, which investigated the workings of the pneumatic tube systems of carrying mails in cities, has reported that, on the present basis of cost, the system is too expensive. A system to be operated by electricity is in process of development and bids fair to be successful. It consists of a miniature third-rail trolley road operated in a tube.

The Boston Electric Elevated Railway—I.

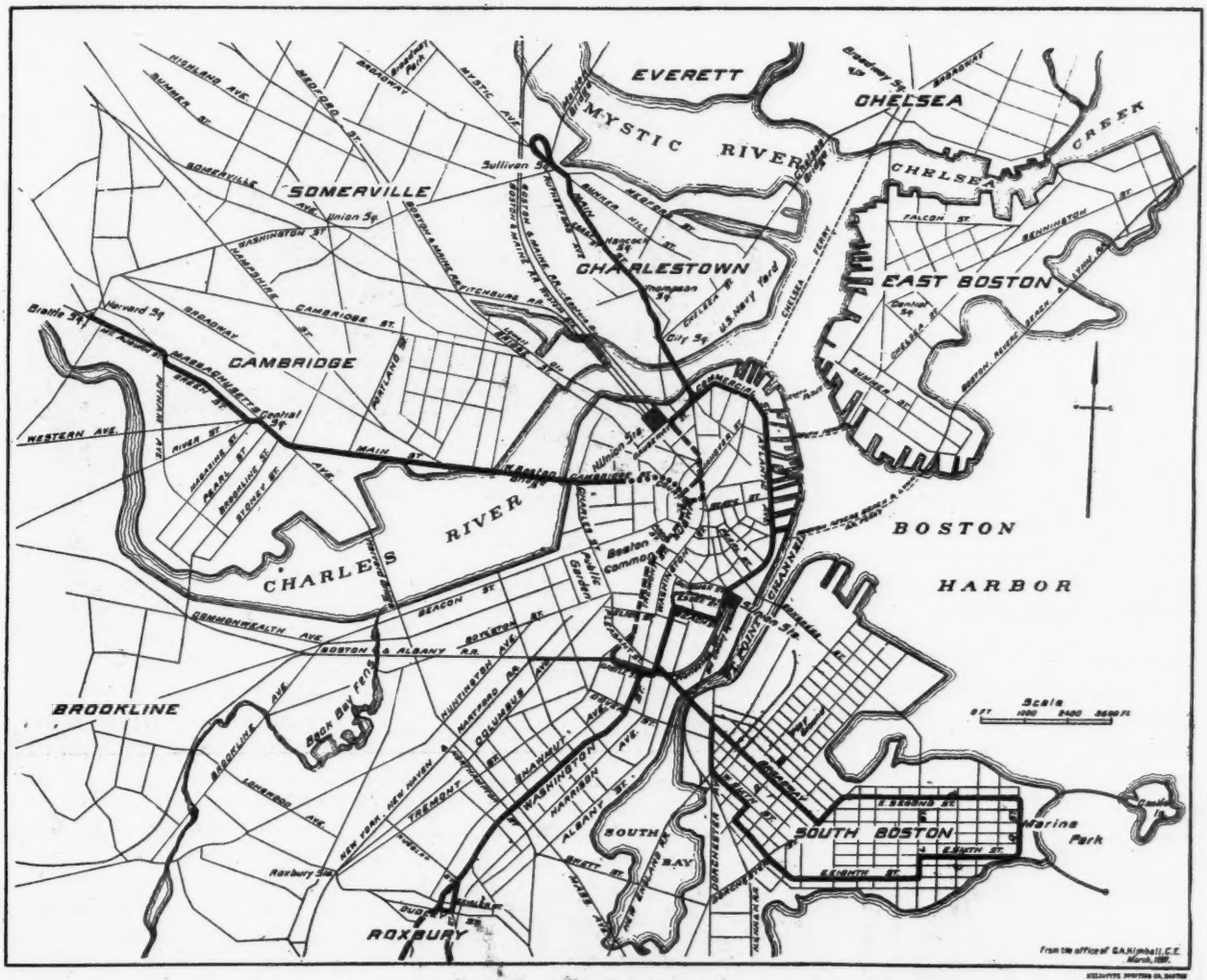
Some Notes on the Equipment of the Boston Elevated Railway Company's New Lines, Power Stations and Trains.

FOR MANY YEARS there has been agitation in the city of Boston, Mass., concerning the necessity for rapid transit. Owing to the peculiar configuration of the city, and the narrow and crooked character of many of the streets in the busiest portions of the town, surface traffic became very greatly congested. It was in Boston that first the trolley car won recognition as a very important factor in public transportation, and the system of the West End Street Railway Company, which has been merged into the present elevated railway corporation, was justly considered in its day to be the finest in the world.

But with the growth of population and increase in use of transportation facilities, the crowding in Tremont and Washington streets, the main arteries of retail trade in Boston, became so great as seriously to congest all traffic and to make an immediate solution of vital necessity. The solution was found to some degree by the construction of a subway. This, running under and alongside the crowded shopping districts, took the cars out of the street in part, and, putting them on a private right of way, permitted high speeds to be made and greatly facilitated methods for handling crowds of passengers; but the subway solution was by no means perfect.

Boston proper is the centre of an urban area of considerable size, and the city itself comprises within its present limits a very large number of what were once suburban towns. In the outlying parts of the city proper, and in the suburbs adjacent to it, the style of building is open and distances are very considerable. The consequence of this arrangement is that the desirable residence portions of the city, lying both to the north and south of the business centres, are so far from the latter that the time taken in making the journey by trolley car is very considerable. Evidently a necessary feature of any solution of the transit problem in Boston involved the operation of high-speed trains to centres in the suburbs, whence feeder lines might radiate to take care of the local distribution of passengers.

Precisely this was done, and an elevated structure, extending from Sullivan Square in the former city of Charlestown (almost within the shadow of Bunker Hill monument) on the north, across the Charles



SKETCH MAP OF THE BOSTON ELEVATED RAILWAY COMPANY'S LINES, CONSTRUCTED AND PROPOSED.
THE LINES FROM CAMBRIDGE EAST TO THE SUBWAY, THROUGH ESSEX STREET, AND FROM CASTLE STREET TO THE SOUTH BOSTON LOOP ARE NOT YET CONSTRUCTED.
THE LINE IN THE SUBWAY IS SHOWN DOTTED.

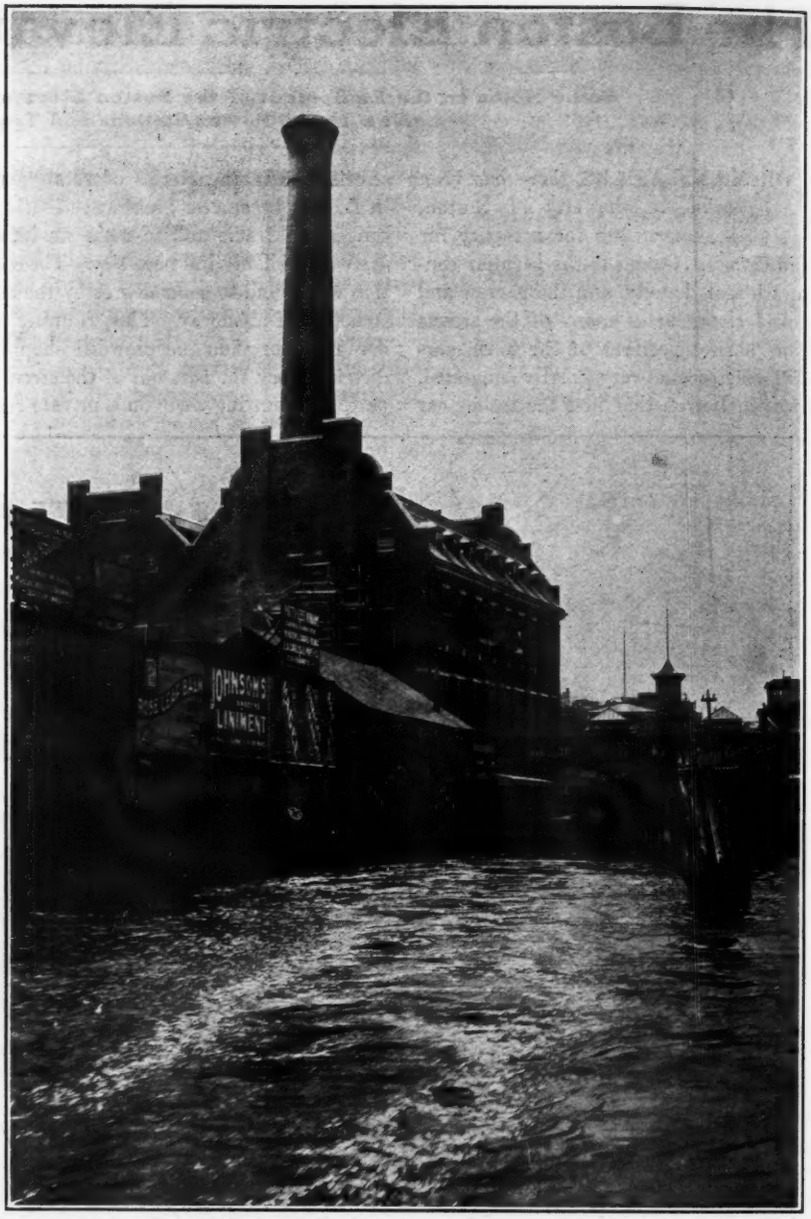
River and to Dudley street in Roxbury, was constructed as part of a system which will eventually embrace four radiating lines of elevated tracks and a loop in the centre of the city.

In going through the crowded business part of Boston two distinct lines are used, making a loop around the centre of the city. This will easily be understood by reference to the accompanying sketch map, which shows the lines projected and completed. On one side of this loop is included the subway; and Boston, distinguished for so many other things, also enjoys the distinction of being the only city in the world having an elevated road which is partly built underground.

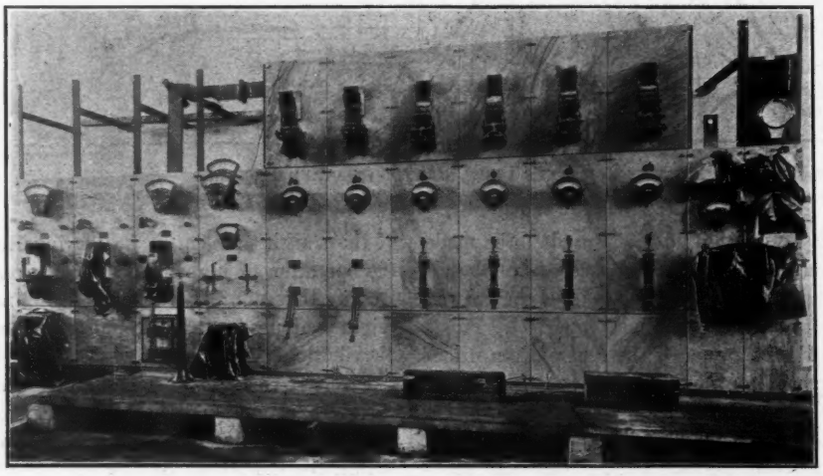
With the consolidation of the numerous street railway interests which went to form the West End Company—the immediate parent of the Boston Elevated Railway Company—a number of powerhouses and substations were inherited, and of these still a considerable number will be used in furnishing current to the general system of the city. It must not be forgotten that all of the transportation systems of Boston are operated as a unit by one company, and that the elevated system and the subway must be considered together with the radiating and intersecting trolley lines on the surface as forming parts of a single whole.

Of the numerous power stations perhaps that one which will be most identified with the elevated railway proper, is the fine station standing on Lincoln's Wharf, in the northern portion of the old city of Boston, and known as the Lincoln power station. One of the accompanying illustrations gives an excellent idea of the station from the water front.

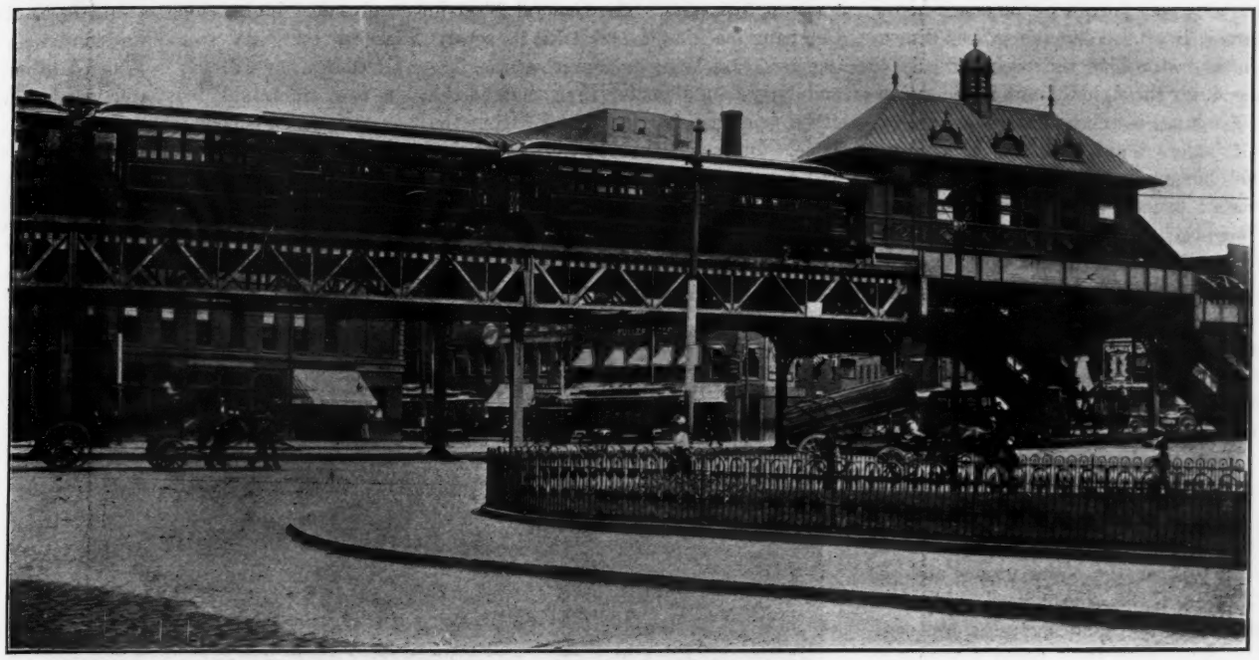
The building is 155 feet by 145 feet in area, and is built of brick with limestone trimmings and a tile roof. Rising from one side of the building is a brick chimney 251 feet high and having a 13-foot circular flue. All of the piping, condensers and pumps are located in the basement of this building below the level of the engine-room floor. The boiler room is at a slight elevation above the ground and above this is carried the coal in pockets. The capacity for coal storage is 3,500 tons in the steel pockets in the building itself, and room for 6,500 tons more is reserved on the company's wharf immediately adjacent to the building. The coal used is of the Pocahontas variety, "run of mine," and is received from barges and schooners at the dock by means of a Hunt coal conveyor. The coal is carried either to the wharf piles for storage, or is sent



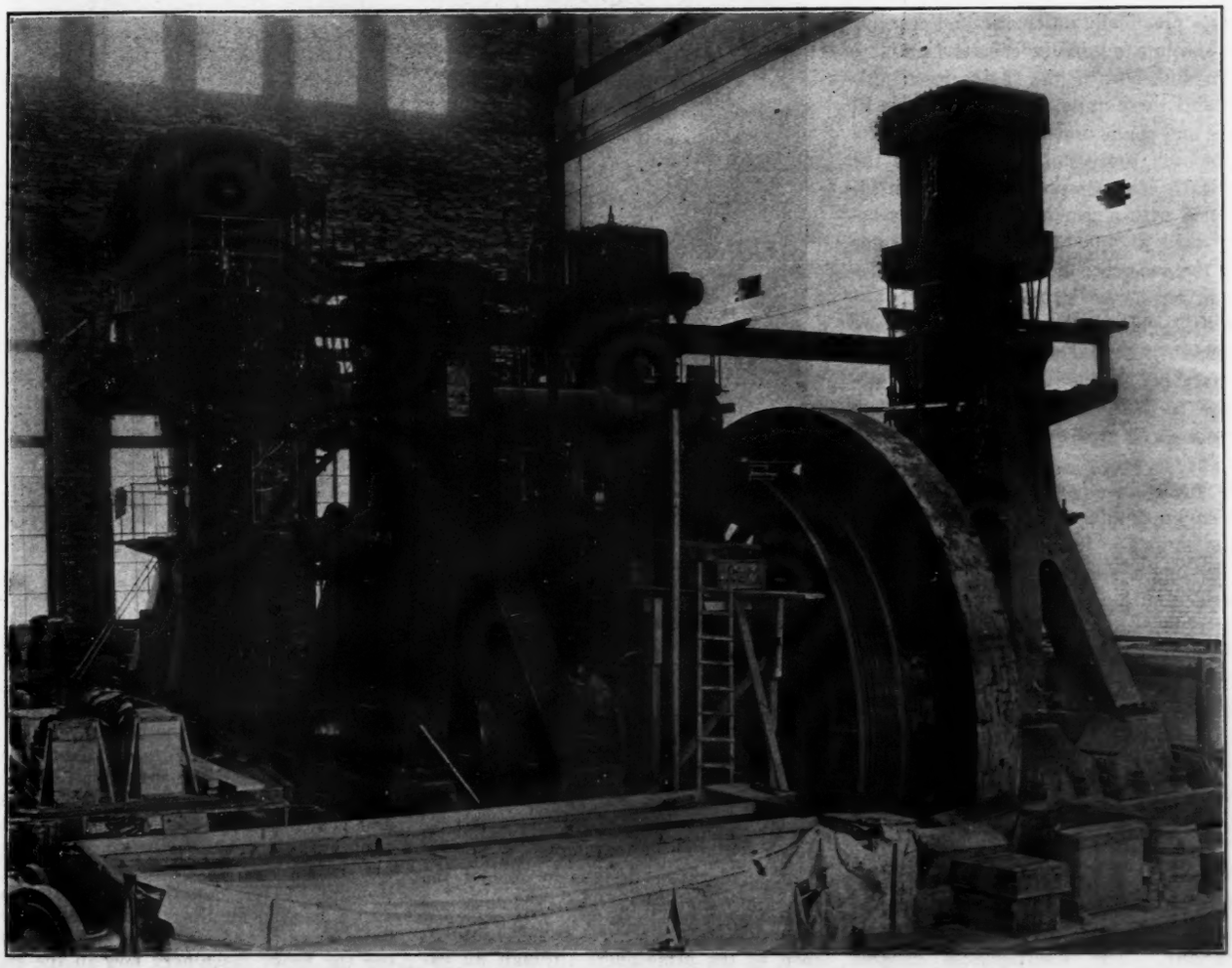
THE LINCOLN POWER STATION OF THE BOSTON ELEVATED RAILWAY COMPANY—FROM THE WATER FRONT.



PARTIALLY COMPLETED SWITCHBOARD IN THE LINCOLN POWER STATION, BOSTON.



A Typical Station on Straight Track, Boston Elevated Railway—City Square Station.



Setting up One of the 4,500-Horse-Power Engine and Dynamo Units at the Lincoln Power Station.

up to the upper portion of the power-house, where it is crushed to the proper dimensions and stored in the pockets ready to come down through the automatic weighing machines to the boilers below.

Of boilers there is a total of nominal 6,000 horse-power, arranged in six batteries of two 500-horse-power water-tube boilers each. The boilers are of the familiar Babcock & Wilcox type, the same company having supplied also the superheaters which are used to superheat the steam to 500 degrees. The working pressure is 185 pounds per square inch at the boilers. Of the 12 individual boilers, eight are equipped with Roney mechanical stokers driven by steam engines, while four are equipped with Acme mechanical stokers similarly driven. All of the boilers work in connection with Green fuel economizers placed between the boiler proper and the uptake into the smoke-stack. The arrangements for handling ashes are complete and simple, these being delivered to carts at one end of the building. The whole progress of the coal, from the time the schooners arrive with it at the wharf until the ashes are carted out of the building, is practically automatic and requires the absolute minimum of attention.

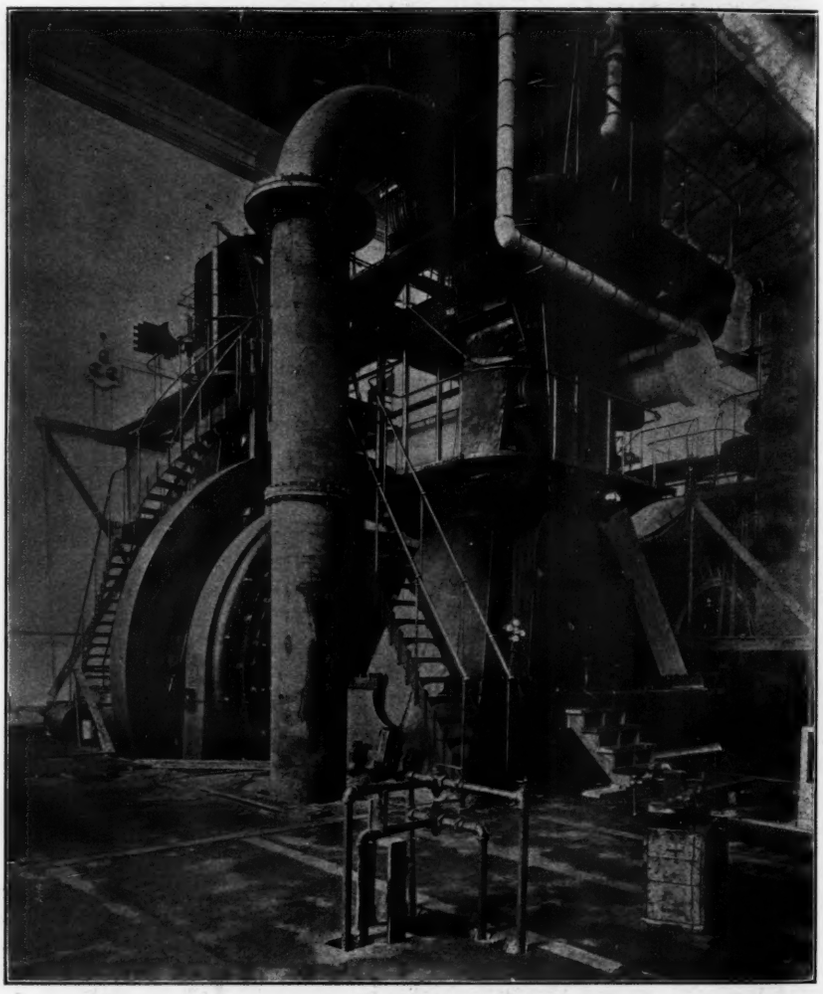
Passing, now, to the engine room, this contains three units, of which two are in place and one is under construction. The units each consist of an engine, of the vertical cross-compound type, direct-coupled with a generator, the engine being rated at 4,000 nominal horse-power and the generator at 2,700 kilowatts, giving direct current at 550 volts.

Of the engines, the two units which are at present installed were built by the Rice & Sargent Engine Company, of Providence, R. I. At 180 pounds initial steam pressure, and at their normal speed of 75 revolutions per minute, these engines indicate 4,500 horse-power. They are of exceedingly simple type, their dimensions being 44 and 88 inches cylinder diameters by 60 inches stroke. These engines are provided with Corliss valves throughout. The other engine unit, which is now being installed, is of the Westinghouse pattern, though similar to the other engines and of the same dimensions, except that its low pressure cylinder is one inch less in diameter. This machine has poppet valves on the high-pressure side and Corliss valves on the low-pressure side.

The two units at present installed drive dynamos of different types, one engine operating a Westinghouse generator and the other one made by the General Electric Company. The Westinghouse dynamo has 22 poles, and is rated at 2,700 kilowatts at 575 volts. The General Electric Company machine has 36 poles, its revolving armature being narrower on the face and larger in diameter than that of the other machine, and its output rating the same. In each combined unit of engine and generator is included a 26-foot diameter, 120-ton flywheel. In each of them the weight on the main bearings is 250 tons, and this in each case is carried by a shaft 34 inches in diameter in the bearings, forged hollow, of nickel steel. The Siegrist lubricating system supplies oil under pressure to sight-feed oil cups all over the working parts of the engines and dynamos from a distributing table, not unlike an electric switchboard in its general design, located near the oil pumps in the basement.

The exhaust pipes from the great engines contain an ingenious expansion joint, made after designs by one of the company's engineers. These exhausts are connected with a 48-inch exhaust header, open to the atmosphere through an exhaust head eight feet in diameter and twelve feet high, which is said to be the largest that has ever been constructed. Of course, air exhaust is resorted to only in case of trouble with the condensing system, which is elaborate and complete.

The whole of the condensing apparatus is of the Blake pattern. The condensers and air pumps are of the combined twin vertical, separate-driven, self-contained type, which has come to be familiar in high-class power installations, there being three units of these machines rated at 6,000 horse-power each. In connection with the condensing system, feed water heaters of the Webster pattern are employed, while the steam coming from the boilers is superheated to 500 degrees, thus insuring, it is believed, a very high economy in the operation of the station.

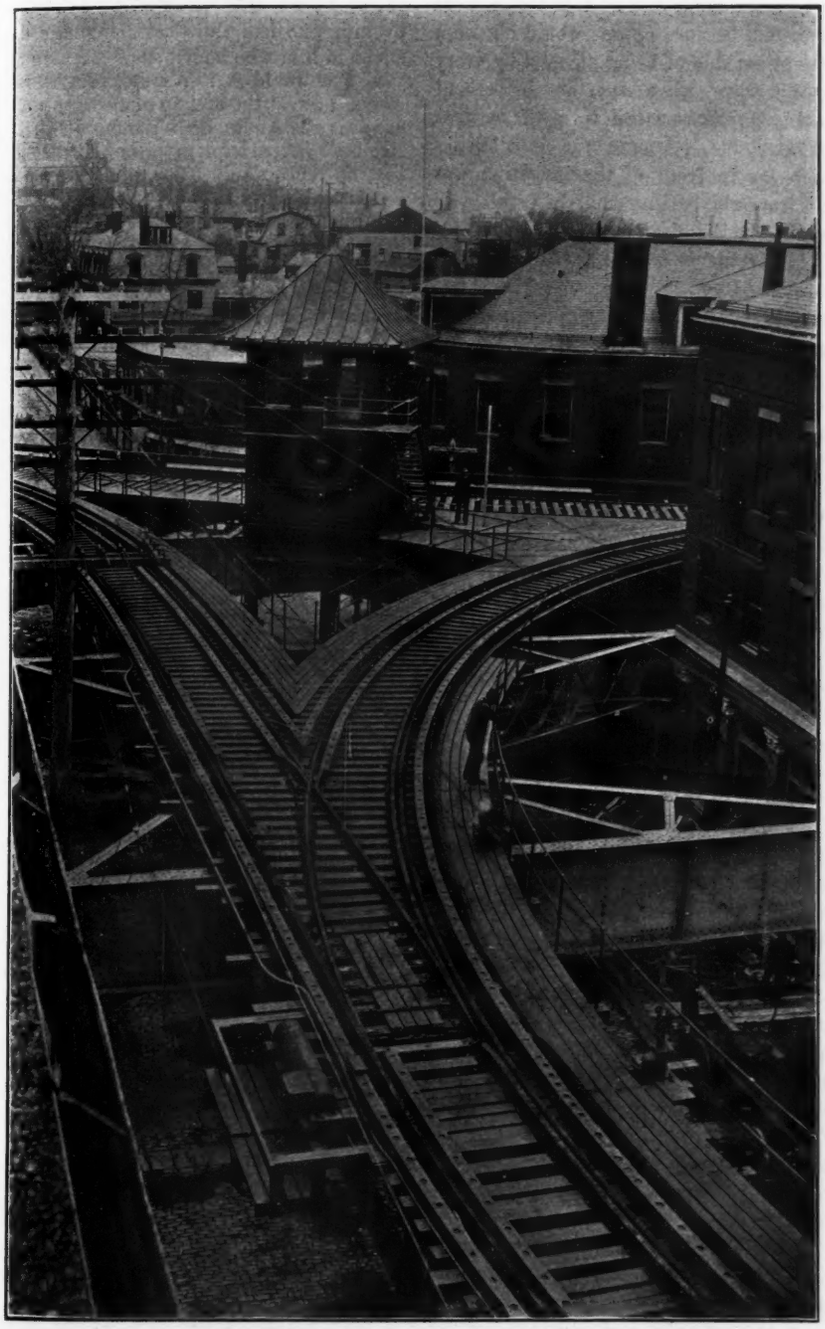


ONE OF THE 4,500-HORSE-POWER GENERATING UNITS IN THE LINCOLN STATION OF THE BOSTON ELEVATED RAILWAY COMPANY.

The building is admirably adapted for station purposes. The interior of the engine room is lined with white-faced bricks, and is spanned by a 50-ton electric crane made by the Morgan Engineering Company, of Mansfield, Ohio, and equipped with General Electric motors. This crane has also a five-ton auxiliary hoist, and it has been found of the utmost service in erecting the heavy machinery now in the station. The southern wall of the building

is of brick, but of a temporary character, as it is expected that it will have to be taken out and the building extended in that direction for the reception of a fourth unit before many years pass.

The electrical connections of this station, while naturally on a large scale, are of the simplest character. Alongside of each dynamo is a monstrous circuit-breaker of the General Electric type, set to break at 6,000 amperes, while upon the switchboard the various circuits are handled through the customary single-pole switches and circuit-breakers employed in railway work. All of the circuits leave the building underground.



Switch on Loop Track, Boston Elevated Railway, Showing Switch Tower and Signals.

Lightning Strikes the Niagara Transmission Line.

On the evening of June 22, during the progress of a severe electrical storm, lightning struck the transmission line connecting Niagara Falls, N. Y., and Buffalo at a point between Niagara Falls and Tonawanda. In an instant Buffalo was in darkness, its street cars were stopped and the Pan-American Exposition was practically paralyzed. Fuses on the line were blown out and it was several minutes before the storage battery plant of the Buffalo General Electric Company could be brought into requisition to take care of the street cars and lights. At the Pan-American, while the decorative lighting was temporarily extinguished, the power supply from the steam-driven power-house on the grounds was continued so that there was no trouble in finding one's way about the grounds. The main troubles were found by various theatres, both on the Midway at the exposition and in Buffalo proper, which were left in darkness. This is the first time that lightning has caused a general suspension of lighting and power delivered through this transmission line since its erection.

A French View of Wireless Telegraphy.

M. Villot, Inspector General of Posts and Telegraphs, and head of a government commission appointed to study wireless telegraphy, is quoted in a press cable despatch as saying:

"Aerial wireless telegraphy can not give entirely satisfactory results, as experiments have been proved to vary with the atmospheric conditions. Furthermore, the horizon remains an insurmountable barrier for long-distance messages, even with relays.

"On the contrary, certainty can be obtained in pouring into known subterranean layers sufficient power to reach a desired point, where perfected apparatus will receive the message. The first duty of the commission will be a thorough study of earthly strata, which the latest geological researches have shown to be imperfectly understood."

A Singular Accident.

On the evening of June 20 a 1,000-kilowatt rotary converter in the station of the Edison Heat, Light and Power Company, in Duane street, New York city, suddenly "ran away," causing its armature to explode and seriously wounding Henry Kraemer, one of the attendants in the station.

The cause of the accident is not quite clear. The machine was one of the standard General Electric Company's 1,000-kilowatt rotaries, normally operating from the alternating-current side to supply direct current to the outside of the 250-volt three-wire system maintained by the company on its lighting circuits. On the evening in question the machine was running backward—that is to say, it was being operated from the direct-current side, feeding current back into the alternating distribution network. Whether it had been thrown in synchronism on the alternating side or not is not quite clear. It is supposed that possibly its field circuit became broken in some way, causing it simply to run away. Lights were out in the downtown district only a few minutes in consequence of the accident and the incidental invasion of the station by the fire department.

Syntonic Wireless Telegraphy.

After the reading of Mr. Marconi's paper, which was printed in full in the ELECTRICAL REVIEW for June 15 and 22, before the Society of Arts, in London, Professor W. E. Ayrton being in the chair, the following discussion took place:

Dr. Fleming, F.R.S., said, that as he had been permitted to be a little behind the scenes, and had seen some of the apparatus before it was made public, he was able to entirely confirm Mr. Marconi's statements with regard to his experiments. A very great stride forward had been made in syntonic telegraphy. The subject was not a new one, in fact, a large number of patents had been taken out in connection with it, most of which, however, embodied more hope than experience. In spite of the fact that there were so many claims of priority in the matter, he had the strongest possible conviction that Mr. Marconi was the first person to actually achieve a true syntonic telegraphy with electric waves. He had done that in virtue of having followed out to their logical issue the fundamental scientific principles of the subject which he had so clearly grasped, one of which was the essential distinction between the radiative and the non-radiative circuit. Many inventors and patentees had professed to have obtained syntonic telegraphy with a simple open aerial insulated radiator of the Marconi type. Although it was possible to produce a kind of bastard syntonic telegraphy by that means it was not possible to produce true syntonic telegraphy, because the aerial simply produced a sort of ætheric impulse or explosion, and not a true train of waves. It was just as possible to produce true syntonic telegraphy by those means as it would be to cause one whip to crack by cracking another one near to it. When a closed circuit was taken, which was a powerful absorber of electric energy, and associated with a radiative circuit, a means was obtained for producing a true train of waves. If those two circuits were tuned together, a great improvement was effected on anything previously accomplished. Mr. Marconi had not only constructed a receiver capable of receiving trains of waves, but also capable of not receiving those not adapted to it. No train of waves would act upon his syntonic receiver except those which had a particular period. An analogy might be found in a cork floating on water, which would be bobbed up and down by any wave, long or short, which went over it; but a heavy log of wood floating on the water and tethered to the bottom of a sea by a spiral spring would only be caused to bob up and down by waves having one particular period. The former corresponded to a simple coherer and the latter to a syntonic receiver of the kind described in the paper. He quite agreed with Mr. Marconi that the days of the non-syntonic telegraphy were numbered, because no one would choose a receiver capable of being affected by every vagrant wave, when such an instrument as Mr. Marconi's latest form of receiver was available. Among the possibilities which lay in front of the invention was that it would be immediately possible to provide the Admiralty and the post office with instruments having an Admiralty or post-office frequency, and to register frequency just as a telegraph address was registered, so that no one else could use that particular frequency. He had had the privilege of riding on the motor car described by the reader of the paper, and, when many miles from home, they were able to communicate with their hotel and order their lunches. In conclusion, he offered his warmest congratulations to Mr. Marconi on the immense strides he had made in the improvement of his initial invention.

Captain Kennedy said he wished to explain, in common justice to Mr. Marconi, some of the points connected with the operation of the system in South Africa. A scheme was suddenly conceived and hastily executed of sending apparatus and assistants to install the system at Durban. But intead of setting it up at that port, it was sent to the front. No poles were available, and the attempts to substitute kites and balloons were unsuccessful. For want of labor and proper materials progress was slow, and eventually the work was stopped. On arriving in Natal, on the first opportunity, he handed the whole system over to Captain Percy Scott, who worked it most satisfactorily on board the ships at Durban up to the time he left South Africa. The operations in Cape Colony were entirely experimental, and would have succeeded had they been given a fair chance.

The chairman, in proposing a vote of thanks to Mr. Marconi for his admirable paper, said that, after listening to what wireless telegraphy had already done in saving life and ships, they realized why the reader of the paper, although so young, had acquired fame, why he had won that more substantial reward which sometimes went with fame, but often did not, and also grasped why he had earned what should be dearer to him than fame or wealth—the gratitude of all peoples for having so courageously developed a new sense for the world. Although still far away, he thought they were gradually coming within thinkable distance of the realization of a prophecy he ventured to make four years ago, of a time when if a person wanted to call to a friend he knew not where, he would call in a loud, electromagnetic voice, heard by him who had the electromagnetic ear, silent to him who had it not. "Where are you?" he would say. A small reply would come, "I am at the bottom of a coal mine, or crossing the Andes, or in the middle of the Pacific." Or, perhaps, in spite of all the calling, no reply would come, and the person would then know that his friend was dead. Let them think of what that meant, of the calling which went on every day from room to room of a house, and then think of that calling extending from pole to pole; not a noisy babble, but a call audible to him who wanted to hear and absolutely silent to him who did not, it was almost like dreamland and ghostland, not the ghostland of the heated imagination cultivated by the Psychical Society, but a real communication from a distance based on true physical laws. On seeing the young faces of so many present he was filled with green envy that they, and not he, might very likely live to see the fulfillment of his prophecy.

The resolution was carried unanimously.

Mr. Marconi, in reply, thanked Dr. Fleming for his kind remarks, to him he was also indebted for valuable advice on many subjects he did not understand, and in which Dr. Fleming's theoretical knowledge was of great value. In reference to Captain Kennedy's remarks, he wished to give an explanation. When the war broke out in South Africa he was asked whether he could send his apparatus out there. His associates, in reply, made two proposals, (1) to send apparatus for work at the front, and (2) between shore stations and the transports at Durban. The proposal of using the apparatus at the front was not accepted by the War Office at the time. The apparatus was sent out without poles, because he was informed they would be found at Durban. On the arrival of his assistants in South Africa they pluckily volunteered to go to the front, thinking the system might be worked with advantage to the English Army, but on reaching the front, poles could not be obtained by which to raise the wires. At that time, according to his old-fashioned system, this was absolutely necessary. Captain Baden-Powell came to the rescue with some well-designed kites and signals were transmitted about 18 miles. Although the system was never used during operations in South Africa, it was not the fault of the system. In conclusion he thanked the chairman for his remarks, and hoped he would be able to improve considerably on what he had done and obtain more valuable results for land and sea purposes. He wished also to thank the Council of the Society of Arts for asking him to read the paper, and the audience for the kind way in which they had appreciated his efforts.

THE ELECTRICAL RESISTANCE OF THE HUMAN BODY.*

BY W. L. HOOPER.

Several years ago while examining the evidence in a case of alleged injury from electrical shock, it became desirable to ascertain the resistance of the human body. An examination of the literature of the subject was most unsatisfactory, different authorities giving values ranging from one thousand to several tens of thousands of ohms; the only rule discoverable being that the better the contact and the more moist the skin, the lower the resistance.

After some preliminary experimenting from which it appeared that the resistance of the body altered with the voltage employed, as well as with the character of the contact and condition of the skin, I requested one of my post-graduate students to examine in as large a number of cases as possible the hand-to-hand resistance of the body at all practicable voltages.

Brass rods about three-quarters of an inch in diameter were selected for electrodes; and the resistances were measured first with a Wheatstone bridge and single LeClanche cell and then with milliammeter and voltmeter and battery of storage cells, varying from a few volts to 75 or 100, and sometimes to 125 volts.

With the Wheatstone bridge and cell the resistances were always high, usually from twenty thousand to forty thousand ohms; with the milliammeter and voltmeter and a number of storage cells the resistances were always lower, decreasing along an apparently hyperbolic curve until with 100 to 125 volts the results obtained were usually between 1,000 and 2,000 ohms.

The accompanying diagram shows the form of the curve according to which the resistance varies, but is not to be taken as an actual case.

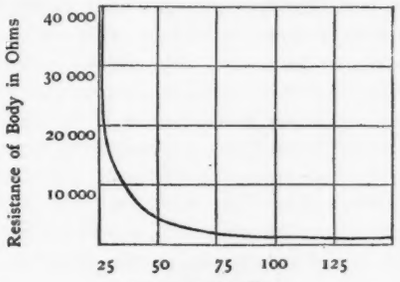
That the diminution of resistance with high voltages was not due to tighter grip of the handles due to muscular spasm was shown by substituting for the rods heavy pieces of metal resting upon the open palms.

That it is a peculiarity of living tissue was shown by experiments with wet leather, meat and dead animals. Experiments with alternating currents yielded the same results, though with a periodicity of 130, no one was found willing to endure more than 50 volts.

In the search for an explanation of these results a distinct increase in the moisture of the skin on the palms of the hands was observed after experiments with high voltages. It accordingly occurred to us that the diminished resistance might be wholly or in part due to the greater activity of the sweat glands due to increased flow of blood to the parts under the stimulus of the relatively large currents at high voltages.

If this is the true explanation, then it should take time to establish the conditions necessary for the low resistance observed at high voltages; and if the observations necessary for determining the resistance of the body could be completed in a brief space of time, for instance, in one or two hundredths of a second, we ought not then to observe any diminution, or at most a much smaller diminution in the resistance for a given increase of voltage. This hypothesis I have lately tested in the following manner:

In series with the body and battery is placed a non-inductive resistance composed of a series of incandescent lamps and a switch for closing the circuit. To the terminals of the non-inductive resistance is connected a condenser whose charge at any instant will, of course, depend upon the difference of potential between the terminals of that resistance and therefore upon the current in that branch at the given instant.



CURVE SHOWING VARIATIONS IN BODILY RESISTANCE.

In the same way another condenser connected to the terminals grasped by the hands enables us to determine the instantaneous difference of potential between the hands.

Both condensers are connected respectively to the two blades of a double-pole, double-throw switch, one pair of whose jaws are connected to the non-inductive resistance and body, the other pair to two reflecting balistic galvanometers. This switch is placed a measured distance below the battery switch above mentioned, and both are actuated by a falling weight.

The operation is as follows: the battery switch being open and the double pole switch being set to connect the condensers to the terminals of the resistance and body respectively, the weight is released, and falling, closes the battery switch, thus establishing the current through the body. After an interval of time, depending upon the distance the weight has fallen and the space between the two switches, the double-pole switch is thrown, thus transferring the terminals of the condensers from the resistances to the galvanometers whose deflections, multiplied by the proper constants, give the potentials at the terminals of the body and the non-inductive resistance respectively. Knowing the value of the non-inductive resistance and the instantaneous value of the potential difference between its terminals, the instantaneous value of the current through the resistance and hence through the body is found. Knowing the current through the body and the difference of potential between the handles, the resistance of the body is determined.

That the indications of this rather complex arrangement of apparatus are reliable is shown by its yielding correct results when known metallic resistances are substituted for that of the human body.

There has not been time at my disposal for anything like an extended series of experiments with the new apparatus, but the results obtained show clearly that the resistance of the body during the first one or two-hundredths of a second after being subjected to potentials of from 50 to 100 volts is much higher than that found after the current has acted for several seconds; resistances below several thousand ohms not having yet been observed.

On the other hand, resistances as high as those found with the Wheatstone bridge and single cell have not been obtained.

It would therefore appear that the decreased resistance of the human body which I have observed with high voltages is at least partly due to stimulated circulation, but that not improbably there are other effects of relatively large currents much more nearly instantaneous in their action, but tending also to reduce the body's resistance.

One evident result of this investigation is to show the utter futility of attempting to determine the amount of current that may flow through a person's body on contact with a high-pressure wire by measuring the resistance of that body with a Wheatstone bridge and one or two battery cells.

* Reprinted from the *Tufts Engineer*.

The Street Railway Convention.

The annual convention of the American Street Railway Association will be held at Madison Square Garden, in New York city, on October 9, 10 and 11, 1901. Headquarters of the association will be at the Murray Hill Hotel.

CIPHER CODE FOR GENERAL RAILROAD TELEGRAPHING.*

BY C. S. RHOADS.

While no doubt the majority of the railways here represented now have, or have had during the past, some form of "cipher code," the fact that your topic committee has asked us to consider the question at this convention must be taken as evidence that there is need of something that will enable a "knight of the key" to have a better conception of the old saying that "brevity is the soul of wit." Can this not be done by reducing the length if not the number of telegrams, so that the poor fellows will have time to exchange witticisms with one another across the table instead of "pegging" away every moment of their hours while on a "trick," and then put in extra time at the close of day in getting together to forward by train mail what should have gone by wire in an abbreviated form, and no doubt have saved money thereby for the company by having them acted upon much sooner?

Since being requested to prepare something on the above caption, the writer has not had time to make any extensive research as to just what extent the "cipher code" is being used, nor with what success among our neighbors. But judging principally from my own limited experience (which has been rather of an experimental nature) I am of the opinion that what we need to make it a thorough success is to have a code that will apply to the stereotyped phrases used in the different departments of the railroad service, and then have same adopted as the standard for North America, the action to make it so presumably to come through the American Railway Association.

On the Big Four system we prepared a code specially for the local freight department, and put it in use between three of the largest cities. The result was of a satisfactory nature so far as applied to the local business of our own road, but when it came to the joint service with connecting lines (which form a large portion of this class of telegrams) we soon observed the necessity for "standard" for all roads to make it thoroughly practicable. Our traveling auditors have a code of their own, which only the general auditors and traveling auditors have copies of, for obvious reasons.

The Association of American Railway Accounting Officers have adopted a code which was formulated by a committee of that association some two or three years ago, which, it seems to me, contains the basis of what might be enlarged upon to fill the requirements of every department of the service. It contains numerous subdivisions, one for each department. For example: Car service department, cipher words beginning with "C;" freight auditing and freight, cipher words beginning with "F;" general freight department, cipher words beginning with "G."

Each subdivision is arranged in alphabetical order, this arrangement being considered better than arrangement by subjects, for the reason that no two persons would have the same idea as to the best way of classifying subjects, etc., under the latter plan. Consequently there would be more or less difficulty in finding a desired phrase, while an alphabetical order is very simple. By having the "code" words in each subdivision begin with a letter having a direct connection with the department using that subdivision, instant reference can be made to the proper part of the code when a message is to be interpreted. They inserted a number of extra code words in each subdivision, with the understanding that after the code was adopted by the association, any road wishing to add one or more phrases might apply to the secretary to insert such phrases, designating a code word for each, and notifying all members of the association by the monthly bulletin.

In addition to a code of the nature outlined above, would it not be well to have a private code for the use of presidents, general managers and general superintendents only. There are often telegrams pertaining to the executive and administrative affairs of the service that should be so strictly private that not even the clerks in their own offices should have copies of their code. It is not my purpose to insert herein a list of code words to be recommended. One can soon be arranged after the matter of adopting a standard has been perfected. At a previous meeting, while the question of unnecessary telegrams was being discussed, a member of the association suggested as a remedy that "each person be furnished a telephone." While this plan is being rapidly adopted, it doesn't seem to have the effect of reducing the telegraphing, which, like our country, appears to still be on an expanding basis. We make a request for a certain number on the telephone, and about two times out of three get the reply, "Line busy." Now, the query is, "Shall our code not be useful in reducing the number of telephones?"

*Read before the Association of Railway Telegraph Superintendents, Buffalo, June 20.

British Pacific Cable.

A surveying party has located the landing site of the British Pacific telegraph cable (which is to connect the Dominion of Canada with the Australian Confederation) on Kelp Bay, near Banfield Creek, seven miles from the entrance to Barclay Sound, and something over 100 miles from Victoria, writes United States Consul A. E. Smith.

The location is described as admirably adapted for the purpose—a good harbor, 12 fathoms of water close to the shore, so that vessels of 10,000 tons can find safe anchorage. The harbor is landlocked, and has a bottom of ooze that it is said will furnish good protection for the cable.

Work has already begun in England on the cable. It is to be 5,834.5 miles in length, the longest yet constructed, and will be transported and laid in one ship, which is now being specially built for the purpose. The cable will run from Vancouver Island to Fanning Island, a distance of 3,337 miles, before a landing is effected; thence to the Fiji Islands, thence to Norfolk Island, and thence to Queensland.

The first installment of cable, including the sections from Queensland to Norfolk, Fiji, and Fanning Islands, is expected to leave England in January, 1902. The second and longest portion is to leave in August, 1902, come direct to Vancouver Island, and be laid from Barclay Sound to Fanning Island.

According to the contract, the whole cable is to be laid and working by January 1, 1903. Unforeseen disaster excepted, those engaged in the work believe this great enterprise, which will cost $10,000,000, will be completed at the date promised.

The Plain Truth.

[*From the Oswego, N. Y., Times.*]

The point raised by the ELECTRICAL REVIEW is that it is not the shock received in the electric chair that extinguishes the vital spark, but the autopsy that follows; and it complains that in no case has the test been made of trying to resuscitate the criminal as in the case of the boy referred to, who, after having received a shock fivefold as powerful as that applied to criminals and apparently being killed by it, was resuscitated. Certainly if this position be true, it is a vastly different matter from that contemplated by the statute. Death by a burning electrical discharge is one thing, death by the autopsic knife—butchery, in a word—quite another.

ON ANODE RAYS.

BY W. HIBBERT.

The following interesting communication is taken from our esteemed contemporary, the London *Electrical Review:*

About three or four years ago, Dr. Gladstone and I conducted some researches on the absorption of X-rays by various salts and metals. The experiments were very numerous and involved the use of many tubes, so that incidentally a great variety of observations were made. In some cases, pure accident led to some notes about anode rays which may interest your readers. M. Sagnac has given some account of similar results.

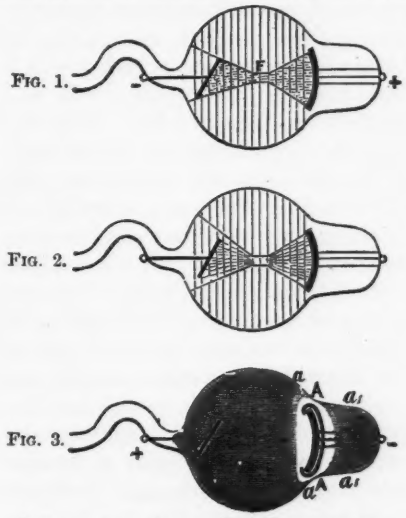
The X-ray tubes employed were of the well-known form shown in the figures, the bulb being about two and one-half inches in diameter, and the distance from the aluminum cup to the platinum plate about one and three-quarters inches.

For the benefit of those who are less familiar with the subject, it will be convenient to describe the appearances observed during the process of exhausting these tubes, when an electric discharge from a coil is used. At a pressure which is relatively great, light appears around the cathode cup, Fig. 3. With increasing exhaustion this light spreads more and more till a converging beam forms. The focus of this cone has a very considerable depth, but divergence over a large area follows, Fig. 2. As the pressure still diminishes, the divergence cone narrows, until it all falls on the flat platinum plate. At still further exhaustion these cones disappear, and the greenish-yellow light which indicates the X-ray stage fills the whole space intervening between the electrodes. At various stages, the platinum plate (anode) is observed to get red hot, which is explained by the action of "cathode rays" from the aluminum cup bombarding the plate on which they are focused, raising its temperature by delivering up to it the kinetic energy they possess.

While at work on these tubes I had the good fortune to see the result of an excessively small puncture, so small, indeed, that the normal pressure was not restored in six hours. The main effects observed were the reverse of those just described as occurring during exhaustion. The greenish-yellow light disappeared; the fairly concentrated cones were followed by the more diffused; and after a little while, light could be seen round the aluminum cup only.

In this deteriorating vacuum I happened to reverse the current, just after the cones had disappeared, and the focus was becoming indefinite. The aluminum cup thus became an anode, and the platinum plate a cathode, contrary to the usual practice. To my surprise, the platinum cathode became red hot, and continued so during the discharge. Even when the battery was switched off, the incandescence was visible, dying away in the manner observed after bombardment by cathode rays. The current was reversed six or seven times, and each time that the platinum plate was acting as cathode it became red hot, though this was not observed when it was made an anode.

It is now granted that the ordinary incandescence of an anti-cathode, or anode, is



Illustrating Anode Ray Experiments.

due to bombardment by "rays" from the cathode. Parity of reasoning suggests that at the particular pressure reached in the experiments just described, the cup-shaped aluminum electrode can radiate anode rays more energetically than cathode rays.

As the leakage continued and the vacuum deteriorated still further, the visible heating of the platinum plate (cathode) diminished and finally ceased. But heating continued, for the bulb was found to be warm over a considerable area near the cathode. At a pressure at which the discharge showed light just round the aluminum cup as cathode, Fig. 3, the current was reversed, and the heating effects were greatest at A A, falling rapidly in front to *a a*, and less rapidly behind to a_1 a_1.

I now tried to obtain evidence of this anode radiation, and consequent incandescence of the cathode, during the process of exhausting a tube. Putting a tube on to a Cossor pump, and running steadily till an ill-defined "focus" appeared between the electrodes (the discharge being in the usual direction—aluminum as cathode, platinum as anode) the current was reversed, and at once the platinum plate began to glow. Here again the anode radiation or discharge is more energetic than that from the same end used as cathode.

Some observations were made during the process of exhaustion by touching different parts of the glass globe. Heating effects were observable over a wide range of pressure, and as soon as the vacuum became fairly good, the temperature was higher round the cathode than near the anode. It is, however, widely and irregularly distributed till a much lower pressure is increased. The bombardment is then concentrated on the cathode as described, raising it to incandescence. The pressure at which this was obtained was proved in various experiments to be just higher than that at which the "focus" becomes visible. In some experiments the platinum was seen to heat first at a point or a very small area, recalling the experimental proof given by Mr. Campbell Swinton of a focal concentration continuing to the anode. Here, of course, the continuation is to the cathode.

These results seem to indicate that during exhaustion of a tube there are both anode and cathode rays, that the line of discharge and concentration for each varies according to the pressure, and that at particular, though different, pressures, it is possible to get convergence of either.

I hope to determine the pressures by the aid of Mr. Cossor's McLeod gauge.

German Technical Bureau.

Steps are being taken for the creation of a federal bureau of technics in Germany. On the executive committee having charge of this plan are members of the leading chemical works, the German association for protecting the trades, the Technical Association of Germany, the Association of German Engineers, the Union of German Patent Lawyers, the Central Bureau for Scientific Investigation, the Institute for Fermentation, the German Tobacco Association, electrical companies and others.

Patent Applications in Great Britain.

In Great Britain last year the number of applications for patents was 23,922, as compared with 25,800 in 1899. The highest point was reached in 1897, with 30,952. It is somewhat interesting to note that, while there has been a falling off in the number of patents granted to citizens of the United Kingdom and also to citizens of Germany and France, the number of applications from the United States increased from 3,002 in 1899 to 3,189 in 1900.

AMERICAN MANUFACTURED PRODUCTS IN GERMANY.*

BY FRANK H. MASON.

It is one of the anomalies of the present situation in Germany that notwithstanding dull and declining home and foreign markets for most products of German manufacture, there is an unusually brisk and insistent demand for certain articles of American origin. During no recent period have so many inquiries, personal and by letter been received at this consulate from German firms and individuals who wish to be put into direct relations with American manufacturers and exporters, as during the first three months of the current year. These inquiries cover a large range of merchandise, including small machinery of many kinds, typewriters, time and cash registers, furniture and office supplies, shoes, leather, lumber, and even dress goods and other textiles of wool and cotton which, surprising as it may seem, are now produced in the United States under conditions which, it is believed here, will warrant their export to European countries.

The significant and gratifying indication in all this is that American manufactures, as such, are becoming well known in Germany and are appreciated and approved for their quality and price. Here, as in Great Britain, an American label or trade-mark has come to be recognized as conveying a certain guarantee as to general excellence in material, workmanship and ingenious adaptation to the purpose for which the article is intended. The American machine tool, the high-grade bicycle, dried and canned fruits, the $3 shoe, the typewriter, the roll-top desk and various fixtures have set high standards of excellence in those specialties, and made the way more open and easy for the other manufactured products which are to follow. In respect to all these things, it is but justice to say that, with few exceptions, German people, especially in the cities and larger towns, have been just and discriminating in their appreciation of American wares, and do not hesitate to buy the imported article when it is better or cheaper than a similar product of native manufacture. So notoriously is this true that purchasers here are often reproached by trade papers and manufacturers' associations with a want of patriotism and a weakness for imported articles which have the merit of novelty. So marked has become the German appreciation of American machinery and tools that the imports last year included 4,757 tons of machine tools of American origin, against 588 tons from Great Britain and 388 tons from France. Besides this, there were imported from the United States, during the same year, 20,249 tons of agricultural machinery and implements, 343 tons of electrical machines, 200 tons of steam engines, 574 tons of blowing machinery and 331 tons of pumps.

But while all this is true, it must be admitted that, except in a few lines, American exporters have been slow in learning the best methods of utilizing the opportunities which are offered in the German market. The makers of machine tools and shoe-making machinery, typewriters and a few other specialties learned the lesson early and well, and have profited by their knowledge. But, as a class, the American manufacturer—incomparable as such—is still in the primary grade as a merchant in foreign fields. That this should be so is, perhaps, a natural result of his education and environment. His success at home has been so complete and satisfying, his confidence in American methods so ingrained and assured, that he finds it hard to realize that customers can not be won in France, Germany, and Russia with catalogues and price lists in English; with measurements, weights and values stated in inches, pounds and dollars; and offering to sell his incomparably superior products for "cash at 10 days sight f. o. b. New York, sight draft with bill of lading attached."

The folly of all this has been explained and written threadbare in consular correspondence and published reports. It has been emphasized in the letters of German agents and importers, but still the confident exporter goes on in his efforts to "teach foreign purchasers American methods of business." If he ventures upon a foreign language it is almost invariably Spanish, and Germany has been strewn with American-Spanish catalogues and price lists which are twice as bulky and no more comprehensible to Germans than if printed in English alone. By way of making it pleasant and easy for the foreign customer, he often encloses a United States stamped envelope, printed with his own address, to contain the returning order. If he sends a traveling salesman or agent to study the market and make personal propaganda, the chances are that the emissary will be a bright, energetic, capable young American, who knows all about the goods and how to sell them in the United States or England, but is ignorant of every language but English and helpless beyond the realm of his mother tongue. Even with these disadvantages, the imperfectly equipped salesman often renders a valuable service by studying the actual needs and conditions of the foreign market, finding how it can be best reached, and, as one of them sententiously remarked, "getting the facts to convince our firm at home that Germany is not in the United States."

In respect to size, beauty of print and illustration, the trade catalogues issued by American manufacturers are the most elaborate and beautiful, as well as the most expensive, in the world, but for practical purposes they are often defective in several respects, the most essential of which are too many claims to superiority and too little definite and exact information concerning the weight, dimensions and effective capacity of machinery; absence of metric weights and measurements and prices in francs, marks or other foreign equivalents; and translations, when given at all, made by persons who do not understand the goods, and which are often so incorrect and imperfect as to furnish no adequate technical description of the merchandise. As a result of these defects, intending purchasers are frequently obliged to open a correspondence with the exporting manufacturer in order to obtain clear and definite information. This entails a serious waste of time and often leads to the loss of orders which are given to manufacturers of other nationalities who make careful and complete catalogues specially for the German market, or, what is still better, send a capable traveling salesman to exhibit samples or photographs of the goods and make direct contracts in the office of the purchaser.

For the fact remains that with all that can be done by other means, it is the expert salesman—the drummer—who is the most effective nurse of new trade, either at home or abroad. The foreign firms or agents are also important adjuncts when they are trustworthy and enterprising, but there is always the possibility that they will hold back the sales of an imported article while pushing those of native production, or they may take advantage of loosely drawn pattern and trade-mark laws to improve their own product at the expense of the foreign competitor. All this is but natural, and must always be taken into account by exporters who place their goods in the hands of foreign agents who are already established in a similar line of trade. Many of such houses in Germany have been enterprising and faithful and have built up an important and permanent traffic in American specialties. Others have utilized the opportunity thus acquired to use the imported machine

* Extracts from a report made to the Department of State by Consul General Mason.

or other article as a model to improve their own products, which they have pushed into complete control of the market.

There should be, therefore, a closer acquaintance and more binding agreement between exporter and agent, and this can be acquired only by personal contact and a more careful study of the conditions and requirements of European trade, made here on the spot by competent merchants or expert salesmen. In large enterprises, the sale of machinery and tools, sales of railway supplies, mining equipments, contracts for bridges, etc., our people have achieved brilliant successes because they have come abroad and done the business directly with purchasers. The enormous increase of the German export trade during the past 20 years is a monument to the efficiency of the good-natured, persistent, highly educated German drummer, who, with sample bag and order book, backed by subsidized steamship lines and German branch banks in foreign marts, has camped in the remotest markets of the earth until he has practically made them his own.

It is an ungracious though sometimes a wholesome duty to point out some of the other errors into which certain of our exporters have fallen through careless overconfidence or ignorance of foreign conditions, and to state from the standpoint of the German importer some of his grounds for complaint. The first of these charges is that American exporters are in many cases too lax and irresponsible in the fulfillment of contracts. As an example of what is meant by this, the following incident will serve: In August of last year, a furnace company in a southern state sold, through an agent in Germany, to a steel manufacturer in the Lower Rhine region 5,200 tons of pig iron, with the express stipulation that 4,000 tons should be shipped so as to be landed at Rotterdam on or before November 15, and the remainder to be landed at Hamburg not later than the same date, so as to be shipped up the Elbe to Silesia before the close of navigation. There had been a dearth of pig iron in Germany during the summer and early autumn of last year, and the purchaser waited impatiently for the American material. Letters and telegrams to the sender evoked no satisfactory reply. The autumn boom in steel manufacture had begun in the United States and he was taking care of his friends at home. Finally, on December 20, 200 tons arrived at Hamburg. The Elbe was then frozen so that it had to be shipped inland by rail. The remaining 1,000 tons of that order and the 4,000 tons for Rotterdam failed to arrive, and the order was cancelled. The Rhineland steel maker accepted the non-delivery because an important decline in the demand and prices of steel had meanwhile occurred in Germany and he could dispense with the American pig iron. But had this been otherwise, he might have bought the whole 5,000 tons in England, Germany or anywhere, paid the market price for it, and collected the difference between that and his contract from the agent who sold him the American metal and failed to deliver it according to agreement. It should be clearly understood that, under German laws, non-fulfillment of contract is a misdemeanor for which the delinquent can be made to pay both actual and contingent damages.

It follows that the German agent of an American exporter, selling goods on commission and depending upon the promptness and good faith of his principal not only for the stipulated delivery, but for the quality of the merchandise, is placed by any default in an exceedingly risky and delicate situation. Being a German subject, he is held subject to the laws of Germany in respect to all contracts made for fulfillment in this country. If he fails to deliver the right goods at the right time, the purchaser may, at his option, cancel the contract or cover it at the risk and account of the commission merchant who represents the foreign seller. Against the honor and good faith of most American exporters nothing can fairly be said, but there are, in several lines of business, firms of easier conscience and sharper methods who do not hesitate to conduct their export trade on the ethical basis of a horse trade and who stoop to practices which are complained of by the victims to their local chambers of commerce, are reported and discussed in newspapers, and furnish the enemies of American imports with just the ammunition that they crave.

In no market of Europe will any trickery of this kind—any lapse whatever from absolute honesty and good faith in the fulfillment of a contract—entail such fatal consequences as in Germany, where every detail of commercial practice is strictly regulated by law.

Another point that few American exporters seem to grasp is that articles made from several different materials—as wood, steel, nickel and copper—are uniformly classified for duty in Germany under the constituent material which bears the highest rate of duty. This has led to some queer and seemingly irrational decisions, as, for instance, where canned vegetables were classified as tinware because the duty rate on tin is far higher than on vegetables. When, therefore, machinery or other merchandise includes parts which are nickeled, upholstered, or otherwise specially decorated, such parts should be packed separately. Letters or catalogues should state precisely not only what the article weighs, but how many cubic feet of space it occupies when packed in the smallest practicable compass for shipping, and whether the individual parts are of steel, brass, iron, wood or other material.

While it is probable that the imports of American machine tools, electrical and even agricultural machinery, may show a marked decline during the current year as compared with 1900 and 1899, there is yet an unsatisfied demand for a wide range of novelties and special inventions in which American ingenuity and adroitness in manufacture have produced something strikingly superior to what is known or used in this country.

As an indication of what is meant may be cited the recent inquiry of a leading importing firm at Berlin, which solicits information and propositions from makers of the most modern and highly improved centrifugal machinery for chemical and laundry purposes, filling machines for charging small paper bags with groceries and medical preparations, filling bottles with salts, etc., and machinery for making pastilles and lozenges of all kinds. It is well known that in these and many other specialties, though not in all, American machinery is unequaled; but there is a lack of means for obtaining here exact knowledge, not only of the latest improvements, but of their weight and cost. Dealers with experience, ample resources and knowledge of the German market are numerous and ready; it is the American salesman with samples and specifications who is generally lacking.

Finally, the American manufacturer who seeks to establish a market in an old and well-supplied country like Germany should realize that it costs something to advertise and introduce a new article, and ought to be willing to pay part of the expense of the enterprise. This he can do by an allowance for advertising purposes, or by granting a longer credit for the goods themselves. Before giving the exclusive agency of a product to a single firm, the exporter should know with whom he is dealing; but, once satisfied on that point, absolute faith should be kept. Many an American exporter has spoiled his chance with the best German importers by sending mailed circulars and propositions broadcast, whereas the article was one which required a special representative agency for its proper introduction. Few responsible houses will undertake the introduction of a new kind of merchandise which any competing firm can obtain direct from the American exporter. In all these respects, business men are very much alike the world over, and it is always a wholesome process for the seller to imagine himself on all questions of detail in the position of the buyer, and consider what he would or would not be willing to do if their relations were reversed.

Some Interesting Telephone Patent Decisions.

On June 7, in the United States Circuit Court for the Eastern District of Missouri, Justice John A. Marshall rendered a decision in the suit brought by the Western Electric Company against the Kinloch Telephone Company and Samuel M. Kennard for injunction and recovery of damages for the infringement of patent No. 438,788, of October 21, 1890, issued to Anthony C. White, for a lightning arrester. In the opinion of the Court, which is long, it is stated that White's patent related to a device consisting of two carbon plates mounted parallel to each other and separated by a thin dielectric, preferably of mica, so slotted as to permit of disruptive electrical discharges taking place through the narrow air gaps at the slots. The upper plate has a plug of fusible alloy fixed in a hole in its surface. In use one plate is connected with the ground and the other with a circuit to be protected. Sudden discharges in small volume jump across the air gap without damage. If any considerable volume of current is present an arc is formed and the resulting heat melts the fusible plug, which runs down and bridges over the space between the plates thus securely earthing the line.

The device used by the defendants consists of carbon plates held apart by a silk dielectric, not slotted, each plate containing in a conical recess a lead shot or pellet held in place by beeswax. The operation of the device also depends on the heat occasioned by the formation of an arc. The Court held that the devices are so nearly similar in design and method of operation that a degree for injunction and accounting should issue.

In the same court and before the same judge another case was decided on June 18 in favor of the Western Electric Company against the Kinloch Telephone Company and others as defendants on three patents two of which had expired. The third is No. 330,067, granted to John A. Seely on November 10, 1885, for grouping spring jacks and annunciators for multiple telephone switchboards. The real issue of this patent was the determination of the infringing or non-infringing character of the switchboard of the Kellogg Switchboard and Supply Company. The decision of the Court embodies over 3,000 words of a somewhat close analysis of the functions of multiple switchboards in general and the history of the art. The main point of difference between the defendants' switchboard and what is known as the full-multiple or Bell type board, embodying Seely's patent in its fullest expansion, is that in the former each board contains multiple jacks only for one quarter of the entire number of lines. Judge Marshall said:

"For the purpose of contrasting the devices, I think each division of the defendants' board should be considered a system or exchange. The subscriber has access to four correlated exchanges, either of which he may call up. So considered, each division of the defendants' device—such as division A—has on its board multiple jacks for all 'A' lines, and also embodies each other element of the Seely patent. An element of the second claim is: 'Addition spring-jack switches,' called in this opinion extra answering jacks, 'distributed on the different boards in uniform groups and the individual annunciators of the different lines arranged in corresponding groups.'"

The decree asked for by the plaintiff was granted.

In connection with this decision the ELECTRICAL REVIEW has received from Mr. Milo G. Kellogg, president of the Kellogg Switchboard and Supply Company, a letter concerning the matter, containing the following:

"The Kinloch switchboard was the first switchboard manufactured by the Kellogg Switchboard and Supply Company. It was begun in the year 1897 and finished the next year. It was not considered by us that the board would infringe the Seely patent, and it is only by the most favorable construction of the patent that it can be considered to do so; for instance, the claims have as elements, in addition to the multiple jacks, additional or answering jacks arranged in 'uniform groups.' Judge Marshall's opinion is to the effect that in the Kinloch board there is not an 'actual uniformity,' but only an 'apparent uniformity,' or a 'uniformity apparent to the eye,' to quote from the Judge's decision.

"Learning in the year 1898 that the Western Electric Company claimed that the Kinloch board infringed the Seely patent, we from that time changed the construction of our switchboards so that it could not be claimed that they infringed the patent, even 'apparently.' All the multiple switchboards which have been constructed by our company, excepting the Kinloch board, which was of date of 1897, have been constructed with this point in view.

"The whole matter is one of minor importance, and the victory a barren one. The case will be appealed and should the Appellate Court decide that the patent is a valid one and is infringed, certain changes could be easily made in the board, which would remove all claim for infringement. Such change would not affect in the slightest the efficiency of the service of the Kinloch company nor the cost of the operation of the Kinloch plant."

Convention of Master Mechanics and Master Car Builders.

The annual conventions of the American Railway Master Mechanics and the Master Car Builders were held at Saratoga Springs last week and the first of this week. A number of important papers were read and discussed. Chief among the topics were the "Cost of Running High-Speed Passenger Trains," "The Handling of Boiler Tubes" and "Reduction in Locomotive Coal Consumption."

The meetings were quite largely attended, representatives being present from every railroad in the United States with the exception of two. There were a number of electrical men in attendance. The Consolidated Railway Electric Lighting and Equipment Company, of New York, was represented by General Manager John N. Abbott, General Agent John T. Dickinson and others. This company had an exhibit in the court of the Grand Union Hotel, which was the convention headquarters, and also had on exhibition, at the Delaware & Hudson depot, a car of the Atchison, Topeka & Santa Fe Railroad equipped with its apparatus. This car was greatly admired and constantly visited by the practical railroad men in attendance, and is one of 106 similarly equipped cars belonging to the A., T. & S. F. road.

The General Electric Company had an exhibit of apparatus suitable for equipping with power the machine shops and repair shops of railroads. The improvements and extensions of steam roads have been so numerous in the last few years that the shop facilities of many of the steam railroads have almost broken down, and new electrical equipment will probably be ordered in many instances. Messrs. Beach, McKee and Mullin were among the representatives of the company present.

The Bullock Electric Manufacturing Company, of Cincinnati, and the Wagner Electric Manufacturing Company, of St. Louis, were represented by Mr. F. G. Bolles, who met many friends among the steam railway men.

The H. W. Johns Manufacturing Company, of New York, had an interesting exhibit, and was represented by Mr. J. H. Meek and others.

The exhibits in steam railway appliances were quite large, and the two conventions were pronounced, in this respect, among the best ever held.

A number of fine souvenirs were distributed by the representatives of manufacturing and supply companies. Among these was a golden pig by Mr. James Brady, of the Pressed Steel Car Company, and a neat pocket and memorandum book of morocco leather with isinglass face by the Safety Company, of New York.

The Fast Saratoga Limited Train.

The inauguration of the Saratoga Limited train service on the New York Central for the summer season occurred Saturday of last week. Mr. George H. Daniels, the general passenger agent of the road, invited a number of his newspaper friends to participate in the inaugural trip and visit the famous springs of Saratoga. A party of some 50 ladies and gentlemen accepted and the train made the trip in a few minutes better than record time both ways, leaving New York at 1.50 P. M. Saturday and arriving on the return at 10.36 A. M. Monday.

Saturday evening a jovial meeting of the party was held in the parlors of the United States Hotel and the Saratoga Limited Club was organized and disorganized. Mr. Daniels was elected president, Mr. Louis Wiley, of the New York *Times,* secretary; Mr. R. K. Munkittrick, of *Harper's Weekly,* was elected historian, and Mr. W. J. Lampton, poet-laureate. A number of humorous reports were made by the officers and responded to by President Daniels in a most felicitous manner. President A. R. Knapp, of the village of Saratoga, welcomed the party in a speech that was most cordial.

On the return trip a vote of thanks to Mr. Daniels, Mr. Burdick, Mr. Wager and their staffs, and to the people of Saratoga Springs, was prepared by a committee and adopted with a hurrah. Mr. J. A. Seavey, of the *Sun,* was chairman of the meeting, and Mr. H. L. Bridgman, of the *Brooklyn Standard-Union,* was secretary. The committee which prepared the resolutions was composed of the historian, the poet and the secretary, and Messrs. Mack, Burton and Price. A verse each of rag-time poetry suitable to the occasion was prepared by Mr. Lampton and Mr. Munkittrick respectively (but not respectfully), and were listened to with many signs of appreciation. The newspaper visitors, in addition to enjoying the waters of the springs, visited the numerous exhibits shown at the convention of the Master Car Builders and found much to interest and enlighten them.

The Berliner Patent Decision.

Mr. Justice Brown, in the United States Court in Boston, on June 24, sent down his opinion in the Berliner transmitter case. The decision is more complete and elaborate than the statement made by Judge Brown last February, consisting of 113 printed pages, but no new points are brought out in it. The rescript of the original statement was published in full in the ELECTRICAL REVIEW for March 2, 1901.

The Canadian Electrical Association's Convention.

The eleventh annual convention of the Canadian Electrical Association was held at the Russell House, in Ottawa, Canada, on June 19, 20 and 21.

Professor R. B. Owens, of McGill University, read a short but interesting paper on "Transformation from Constant Potential Alternating to Constant Current Alternating." This particular transformation is desirable for the operation of series alternating arc lamps from a constant-potential generator, thus combining arc and incandescent lighting systems upon one machine.

Mr. K. B. Thornton, of Montreal, presented a paper on the "Construction and Protection of Aerial Transmission Lines." This paper will appear in full in an early forthcoming number of the ELECTRICAL REVIEW.

Mr. O. Higman, of Ottawa, read a very fully worked out paper on the "Legal Electrical Standards of the Dominion of Canada." It appears from this paper that considerable progress has been made in Canada in the direction of establishing a standardizing bureau.

Mr. Henry L. Doherty, who was recently elected president of the National Electric Light Association, presented an able paper on a subject with which he has long been associated—the method of charging for electric light.

Mr. J. R. Robertson, of Montreal, read a paper entitled "The Influence of the Load Factor on the Design and Operation of a Lighting and Power System." Mr. Robertson's paper was long and very interesting. He went at great length and with much detail into the interesting questions involved, and gave a mathematical demonstration of the accuracy of certain tests suggested in his paper.

There were two topical discussions—upon the "Best Practice in Cleaning, Trimming and Inspection of Enclosed Arc Lamps," and upon "Different Systems of Charging for and Measuring the Power Consumed by Induction Motors with Varying Power Factors."

At the last day's session it was decided that the next meeting should be held next summer in Quebec. The following officers were then elected for the ensuing year:

President, Mr. Philip G. Gossler, of Montreal; first vice-president, P. F. Reesor; second vice-president, Edward Slade; secretary and treasurer, C. H. Mortimer, Toronto. The executive committee is composed of Messrs. J. J. Wright, Toronto; Ormond Higman, Ottawa; A. B. Smith, Toronto; W. H. Browne, Montreal; John Yule, Guelph; A. A. Dion, Ottawa; A. Sangster, Sherbrooke; George Holeman, Quebec, and K. B. Thornton, Montreal.

Association of Railway Telegraph Superintendents.

The Association of Railway Telegraph Superintendents met at Buffalo and continued in session during June 19, 20 and 21 of last week. The meeting was held in Statler's Hotel, near the exposition grounds. Wednesday's session began at 10 o'clock, with Mr. W. F. Williams, of Norfolk, Va., the president, in the chair. The officers and committees submitted their reports, which were accepted. Papers relating to the interests of the telegraph branch of railway work were then read and discussed. There were over 100 in attendance and this number was increased the next day. On Wednesday afternoon, Acting General Manager Pope, of the Bell Telephone Company, entertained the visitors and their wives at the executive offices of the company. An inspection of the modern operating apparatus and switchboards was made, after which lunch was served. The visitors were also addressed by Mr. Pope.

The proceedings continued through Thursday and Friday. On Thursday afternoon, through the courtesy of the telephone company, represented by Mr. Pope, the association visited Niagara Falls and took a trip over the Gorge Route. The trip was a particularly enjoyable one.

Boston was selected as the place of meeting for next year, and Mr. C. F. Annett, superintendent of telegraph of the Illinois Central Railroad, was elected president, and Mr. F. P. Valentine, superintendent of telegraph of the New York, New Haven & Hartford Railroad, was elected vice-president. Mr. P. W. Drew, superintendent of telegraph of the Wisconsin Central Railway, was reelected secretary and treasurer.

J. H. Bunnell & Company, of New York, were represented by Messrs. Charles McLaughlin, Jr., and J. J. Ghegan, and exhibited a handsome line of instruments and also the Phillips-Morse automatic telegraph apparatus.

The Bunnell Telegraphic and Electrical Company, of New York, was represented by Mr. H. S. Young, who distributed as souvenirs sterling silver match boxes, upon which the name of the company was engraved.

Several of the papers read at the convention are published in the ELECTRICAL REVIEW.

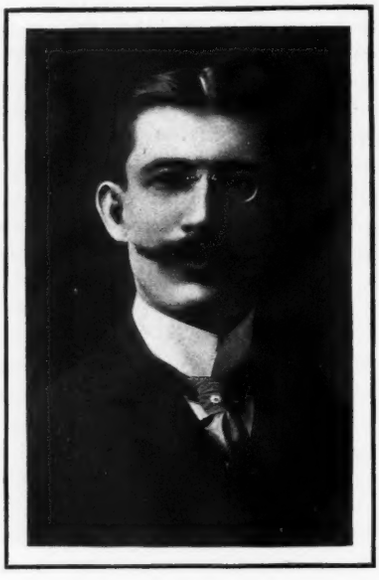
Ten thousand tons of carbide of calcium are produced annually in Germany. The plants making it are as follows: Rheinfelden, 5,000 horse-power of water power; Lechbruck, 2,000 horse-power, water power; Lauffen, 600 horse-power, water power; Hagen, 500 horse-power, steam, and Phœnix-Dortmund, 1,000 horse-power produced by blast-furnace gases.

The Mechanical Forces of Nature and Their Exploitation.

The question of the probable end of the world's coal supply, in the not far distant future, is one which has, in recent years, been the cause of much discussion. In connection with this subject a pamphlet published by the Urania Gesellschaft, of Berlin, on "Die mechanischen Naturkräfte und deren Verwertung," by F. Reuleaux, is of interest. In a clear and popular manner the author traces and explains the gradual utilization by mankind of the various natural forces, from the ancient Assyrian water-wheel to the installations of Niagara, and the Parsons steam turbine. It has been calculated that the supply of coal in England can only last at the most 200 years more; and though the coal fields of the other European countries have not been used to the extent that the English ones have, still their eventual exhaustion can already be anticipated. The total consumption is now about 600,000,000 tons per year, or, measured as a volume, about 500,000,000 cubic yards. Assuming a yearly increase of five per cent (it is at the present moment greater than this), this would mean that during the present century 6,500,000,000 cubic yards of coal would be taken from the earth's coal mines. A cube of this volume would have a side over 10 miles long.

It may be urged that this is not a matter of immediate importance; still, in considering the future industrial state of the world one must admit that great changes must take place, and that countries which have been indebted for their growth to their natural resources of power in the form of coal must give way to those countries where power is supplied in another form. On examining the natural sources of power, one sees that really the only other available source of power besides coal, which, it may be said, can be regarded as the accumulated energy of the sun, stored up through countless ages, is water power. This, unlike coal is a source of energy which is always with us. The sun piles the waters of the ocean upon the mountain side, and following the force of gravity it flows down again in a never-ending cycle, watering, fertilizing, and, under the careful direction of mankind, rendering the land fruitful and inhabitable and providing for the wants of the human race a source of power immeasurably greater than any power to be derived from the combustion of coal, and, what is more, a source of power which will never cease or be exhausted while the world lasts. To form a computation of the total energy of the atmospheric depositions is very difficult. It has been calculated to reach the value of 100,000 million horse-power. The realization of the one-thousandth part of this would be enough to replace the whole of the coal consumption for an incalculable time to come.

An example of how a water power can be used to its fullest extent is furnished by the Upper Hartz. There nearly every drop of water available is utilized, and, although boasting no streams of any size, the respectable total of 3,300 horse-power is generated and used in the mining operations carried on there. It is, however, with the advent of electricity that the full realization of water power has become possible. By means of the facilities offered us by this agent we arrive back at the original motive power of mankind, and will be enabled to tap energies incalculable in comparison with our present ones. This greatest and farthest reaching application of electricity is but now in its infancy. In 1891, only 10 years ago, the first long-distance power transmission plant was erected at Lauffen on the Necker. The power, amounting to 100 horse-power, was transmitted to the electrotechnical exhibition at Frankfort-on-the-Main, a distance of 110 miles, at a voltage of 8,000 volts, using a three-phase current. In the short space of time since then immense progress has been made. Now whole towns and large tracts of country are supplied with power and light from distant waterfalls, and new industries have sprung into existence which were formerly impossible. The future developments of this branch of science will be as great, comparatively, as the mighty forces of nature they are designed to employ, and in endeavoring to imagine them the scientific mind merges into the poetic, with which it is, after all, very closely related.—*Nature.*



Mr. L. W. Stanton.

L. W. Stanton.

Mr. L. W. Stanton was one of the pioneers in independent telephony, having assisted in the construction of one of the first, if not the first, independent telephone exchange in the country, which was built at Cambridge, Ohio, in the fall of 1893. After this plant was completed he accepted an offer to construct and manage a plant at Barnesville, Ohio. This was so well built that it was considered, even by the Bell company's engineers, the best-constructed independent plant in the State of Ohio. Shortly after Mr. Stanton's resignation the plant was purchased by the Bell company.

Mr. Stanton, after leaving Barnesville, went to St. Louis, where the telephone business was quite active, his principal aim at that time being to become familiar with every phase of telephone engineering. He spent several months in the employ of the Bell company in different departments and, after the completion of the Bell plant, he spent some time in the employ of the Standard Underground Cable Company and the Kellogg Switchboard and Supply Company. The latter company, after it had completed the switchboard for the Kinloch Telephone Company, in St. Louis, transferred Mr. Stanton to Cleveland, Ohio, where he had charge of the installation of the switchboard for the Cuyahoga Telephone Company, which is said to be the largest switchboard in the country. After completing the installation he secured a position with the Federal Telephone Company, which controls a number of exchanges in Ohio, besides the United States long-distance lines. His paper, read at the telephone convention recently attracted much favorable comment.

Exports to Spain.

The commercial relations existing before the war between Spain and the United States appear fully to have been restored, and it is considered not at all improbable that our exports to that country for the fiscal year 1901 will be greater, with possibly one exception, than in any preceding year. The figures for the year up to date indicate that the total exports for the fiscal year will reach in the aggregate about $16,000,000, whereas in 1900 they were but $14,619,335, and in 1883, the one year in which more than $15,000,000 was reached, $16,931,287. The annual imports of Spain to the United States since 1891 have ranged from $3,500,000 to $6,000,000, the mean being about $4,500,000. In the present fiscal year they are estimated as likely to exceed somewhat $5,000,000.

Lambert Schmidt Telephones at the Independent Convention.

The Lambert Schmidt Telephone Manufacturing Company, New York, had an elaborate exhibit at the Independent Telephone Convention. The exhibit consisted of two portable army field switchboards,

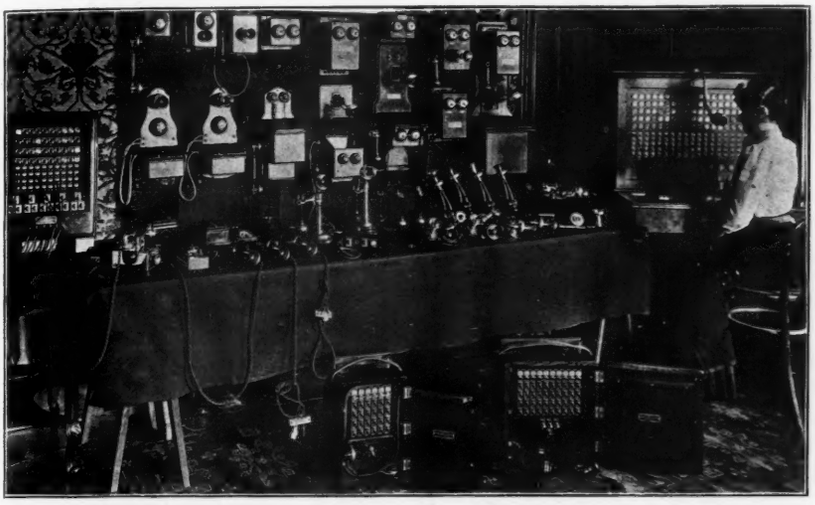


EXHIBIT OF THE LAMBERT SCHMIDT TELEPHONE MANUFACTURING COMPANY AT THE INDEPENDENT TELEPHONE CONVENTION.

one 40-drop regular type army board and a 100-drop combined series and bridging switchboard. There were shown further army telephone field sets, regular exchange telephones, consisting of generator call and common battery wall instruments, portable desk telephones, microtelephones and automatic reset intercommunicating wall and desk sets, as well as many combinations of private line instruments. Parts, in detail, of the company's cordless adjustable arms, transmitters, receivers, etc., were also shown.

The company made a particular feature of showing the inside of both switchboard and telephones, as illustrating the workmanship throughout. The two army portable field switchboards attracted considerable attention, being a novelty in the line. These boards are of six and ten drops, respectively. No cords or jacks are used. All the parts are enclosed in a heavy, compact oak case with a door at the front and back. Inside, at the front, is a hard rubber panel, on which is mounted in the first row 10 drops, on the second row 10 red ringing cams, the third, fourth and fifth rows being composed each of 10 black cross-connecting cams, and the sixth row of three white listening cams. Below is a night bell cam. There is one ringing cam for each line and one listening cam for each row of black cams. The cross-connections on the first call would be made on the first row of black cams, using the first listening cam to the left; the second cross-connection would be made on the second row of black cams, using the second listening cam, etc. Ringing on any line can be done by the individual red ringing cams. The board is provided with the maker's army type hand microtelephone and bridging generator and with binding-posts at the top for line connections. It weighs 63 pounds, is compact, and can be shifted at a moment's notice. A strap at the top is used for carrying.

The company was represented by Mr. Lambert Schmidt, president; Mr. Schwartz and Mr. W. W. Bostwick, Jr.

Keep Cool while You Work.

The neat little apparatus illustrated in the accompanying engraving consists of a small fan, which is part of the stand and fixture of an incandescent lamp and is

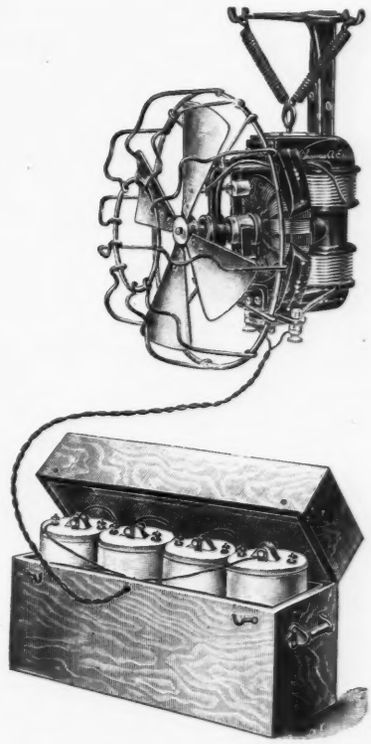
DESK FAN AND LIGHT FIXTURE.

operated in series with the lamp. The fan is five inches in diameter and runs at 1,800 revolutions per minute, giving a gentle breeze, but one not sufficient to disturb papers or writing material placed on a desk in front of it. The height of the whole outfit is 12 inches and its weight complete, four and one-half pounds. It is built to operate on direct or alternating current, and for any of the usual voltages, by the Pacific Electric Company, La Crosse, Wis.

A Suspension Battery Fan Motor Outfit.

In the accompanying illustration is shown a very neat and convenient form of fan motor, operated by battery power, which is made by the Edison Manufacturing Company, New York.

The motor is so well shown in the illustration as to render further description unnecessary. The fan is nine inches in diameter, and is believed to be sufficiently large for the great majority of uses to which an electric fan is put. Power is



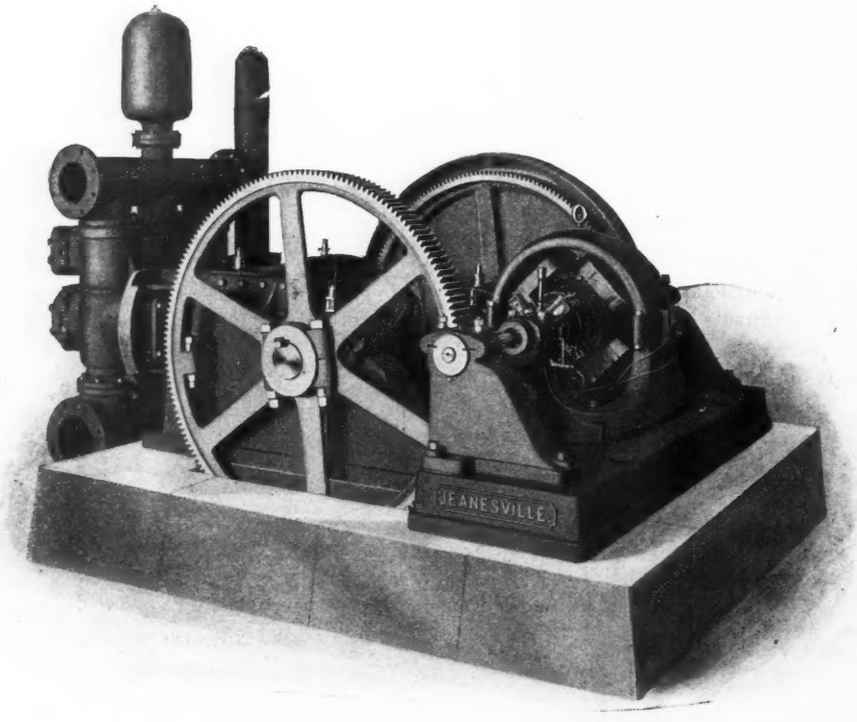
SUSPENDED BATTERY FAN MOTOR.

supplied by four cells of the Edison-Lalande type in a box made of polished oak. By the use of the spring suspension, which is well shown in the illustration, and ball bearings on the motor, it is stated that the operation of this fan is as nearly noiseless as it is possible for a machine to be. The outfit is, therefore, specially well suited for use in sleeping rooms, sick rooms, hospitals, etc. A large number of other uses will readily suggest themselves.

A New Triplex Electric Pump.

In the accompanying illustration is presented a view of the new triplex electric pump designed and built by the Jeansville (Pa.) Iron Works Company.

The general design of the apparatus is that of a horizontal single-acting pump with direct connection, single reducing gears, and having three separate water cylinders which vary in details of construction with the pressure against which the machine is to work. When the pressure on the pump is more than 350 feet lift an alleviator, consisting of a movable plunger backed by a rubber bumper as a spring, is used. As the pressure rises above the normal the spring is compressed, relieving the pressure, and when the plunger falls the spring extends, forcing the piston down and thus restoring the pressure to normal. The motor connections and gearing are simple and practical, the application of power being equal at either end of the crankshaft. The housings of the pump are fortified and support the motor, thus making the entire machine one compact and self-contained body. All parts

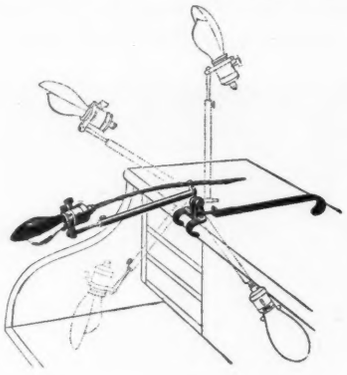


Triplex Electric Pump.

subject to wear are built solidly and are self-lubricating. The manufacturer states that this pump is so massive and contains such a surplus of strength and capacity that its normal work is but a small part of its total power.

The Ferguson Electric Light Bracket.

The Smith & Hemenway Company, of New York, is introducing the Ferguson adjustable lamp bracket, which is one of the most novel and up-to-date roll-top



Electric Light Bracket.

desk lamps on the market. It is adjustable to any size roll-top desk or upright piano and can be fastened on without the assistance of screws or nails. The reflector can be placed at any desired angle to prevent a glare in the eyes. It is ornamental because it is handsomely finished in enamel and nickel. It is very durable. It is simple in construction and operation, and is quickly adjusted. There are no springs to get out of order or make bad contact. The accompanying cut illustrates a few of the angles at which it can be placed.

Metric Screw Threads.

The International Committee of Weights and Measures, which met at Paris last September, has recently published its transactions. Among other matters that this committee has taken up is the vexed question of an international series of sizes of screw threads based on the millimetre.

The annual expenditure of the committee amounts at present to 75,000 francs, but it would appear that at the general conference to be held at Paris in October next, under the Metric Convention 1875, a proposal is to be made to raise the annual budget to 100,000 francs, at which sum it was formerly fixed, so as to meet necessary expenditure on the instrumental equipment and maintenance of the bureau. Toward this annual expenditure each high contracting state contributes a sum based on its population, and on the extent to which the metric system may be in force within each country; Great Britain contributes about 5,000 francs. Some effort appears to have been made in September last by the Decimal Association (London) to induce the committee to lay before the French Government a proposition to invite the attention of the governments of Great Britain, Russia and the United States to the desirability of making the metric system compulsory in these countries; but the committee do not appear to have approached the French Government on this delicate proposition. From the communications addressed to the committee by Professor A. Michelson, Chicago, Mr. Chaney and Professor Mendeléeff, it seems that the metric system is, however, making way in the three great countries above mentioned.

Railway Concessions in Nicaragua.

Consul Donaldson reports from Managaua, May 4, 1901, that the government has granted a concession to Mr. H. C. Emery, of Chelsea, Mass., who already holds valuable timber concessions in the country, to build a railroad from Matagalpa to the head of navigation in Rio Grande—about 100 miles of road. Mr. Emery is allowed one year after ratification by Congress to organize his company and one year and a half more to make the necessary surveys, and must have the road finished and ready to open to the public five years after above date. He is also granted rights and exemptions for all colonists brought in for 25 years. He is also to receive a concession of public lands in alternate lots along the line, one mile wide and four miles deep, and rights of navigation on the Rio Grande and the Atlantic coast.

Current Electrical News

Commercial News

EXPORT AND DOMESTIC

There are renewed rumors of the probable consolidation of the San Francisco Gas and Electric Company with the Independent Gas and Electric Company. The price of the stocks of both companies increased on the strength of this probability.

Rumors are circulating again to the effect that the consolidation of the General Electric, Westinghouse and Sprague interests (the latter represented by Mr. Frank J. Sprague), is about to be effected. The rumor, however, is denied by the principals in New York, but a number of parties interested in the different companies think the consolidation is only a question of time.

It is reported from Philadelphia that a large stockholder in the Telephone, Telegraph and Cable Company stated: "We are busying ourselves preserving for the stockholders whatever there is for them in the company and we are reaching a point where we can tell whether this end can be gained better by going on with the company or winding up its affairs."

There is to be a revolution in the old cathedral of Notre Dame. In future the church is to be lighted by electricity. In spite of its enormous size, Notre Dame has hitherto been simply lighted by wax candles, as gas, it was thought, would damage the walls and valuable paintings. The cost of installing the electric light is estimated at £18,000.

Among the many charters just issued at Harrisburg, the most important, so far as mileage is concerned, is one providing for a continuous trolley line from Harrisburg, Pa., to Washington, D. C., *via* Gettysburg, Mechanicsburg, Carlisle and Baltimore, having as feeders all the intervening towns and villages, and an agricultural section with no transit conveniences except that of the horse. I. A. Sweigard, formerly general manager of the Reading Railroad, is president of the company.

A huge salt and electric power plant has been organized for the Rouge district by Mr. James D. Hawks, of Detroit, Mich. The company is to be incorporated under West Virginia laws with a capital of $6,000,000, and the plant will use about 15 per cent of the live steam to generate electricity as a bi-product, and is to manufacture salt by a new process using exhaust steam for this purpose. The electricity obtained will be used for both power and lighting purposes, and the company expects to supply it within a radius of ten miles around Detroit.

A scheme is being promoted for a series of important tramways in the district of Wakefield, Yorkshire, England. It is intended to construct an electric tramway to connect Ossett with Horbury, which town is to be joined with Wakefield, a city of some 30,000 inhabitants. Then it is proposed to construct a line from the centre of Wakefield to the colliery district of Outwood and thence through Lofthouse and Rothwell to Hunslet. At this point the system would join the Leeds Corporation Tramways. The extent of the projected lines will be about 18 miles.

The Austrian Government not only protects but subsidizes home industries, and has threatened to withdraw the subsidy from a hat factory for ordering an electric lighting plant from Germany. It was dissuaded from this only by evidence that no Austrian firm could have filled the contract. A match factory bought foreign material and was reprimanded by the government. A couple of electric tramway companies bought motors in Germany and were fined for it. Another was permitted to buy its equipment in Germany upon evidence that it could not get what it needed at home.

The Richmond Electrical, Railway and Development Company, which controls the entire water power of the James River, is beginning to work what promises to be an industrial revolution in Richmond, Va., the influences of which are just beginning to be felt. The largest manufacturing firms heretofore run by steam, are changing to electricity. The Trigg Ship-building Works, which has just increased its working capital to $3,000,000, and the Richmond Locomotive Works, employing 2,000 men, has already changed. The accessibility of the power is expected greatly to stimulate small manufacturing. There is considerable new building in Richmond at the present time.

It is officially announced that the General Electric Company has completed negotiations for the purchase of the British Thomson-Houston Company. Great works are being constructed at Rugby, and it is probable that part of the American company's output in the United States for the colonial trade will be produced hereafter at this place. Thus the General Electric Company at Rugby and the Westinghouse plant at Trafford Park, Manchester, will come into direct competition in Great Britain. C. A. Coffin, president; Eugene Griffin, first vice-president, and W. J. Clark, general manager of the foreign department General Electric Company, will be members of the British Thomson-Houston board, and the closest co-operation will exist between the General Electric and the British Thomson-Houston companies.

The longest electric railroad in the world will be built from Cincinnati, Ohio, to Pontiac, Mich., a distance of about 305 miles, if present plans are carried out. The Everett-Moore Syndicate has obtained control of the Miami & Erie Transportation Company and the Detroit & Pontiac Railroad is extending its line 35 miles from Detroit. The consolidation of the Toledo & Detroit Shore Line and the Toledo & Short Line combined with the other roads of the Miami & Erie Transportation Company, gave the Everett-Moore Syndicate exclusive control of the field. The officers of the company are: W. H. Lamprecht, president; W. S. Hayden, secretary, and Otto Miller, treasurer. It is estimated that the first division of the line betwen Cincinnati and Dayton will cost $3,000,000 for the construction alone.

Consul-General Goodnow, of Shanghai, China, under date of May 3, reports as follows: "Aside from cotton goods, I am of the opinion that more merchandise was imported into China from the United States in 1900 than in 1899, in spite of the general decrease of trade. It is impossible to give exact figures on this subject, as the publications of the imperial maritime customs, so far as regards trade of the United States with China, are misleading. The customs credit the trade to the country from which and to which the carrying ship clears, without taking any note of the country in which the goods originated or for which they are destined. All goods shipped by Canadian Pacific steamers are credited to British America; goods shipped *via* Hong Kong are credited to Hong Kong; goods shipped *via* London are credited to Great Britain; the large shipments from the Pacific coast *via* Japanese lines are credited to Japan. The amount of American trade, particularly, is minimized by this method." In regard to transportation he states that it is gratifying to know that new and large steamers are being added to the San Francisco line, and that a new line is being established from Portland, and also a line from Seattle. These new vessels will come into service this fall and winter. In the year 1900, 144 vessels bearing the American flag cleared from the Chinese port in the foreign trade.

Legal Notes

HEAVY DAMAGES AWARDED—In the Supreme Court of the Borough of Brooklyn, New York city, on June 17, Miss Julia C. Bennett obtained a verdict of $17,500 against the Brooklyn Heights Railroad Company for injuries received in a collision. Appeal will be taken, but it is stated that an offer of $10,000 to settle the case out of court has been made.

A NEW RULING ON PATENT RIGHTS—A ruling of Judge Kohlsatt in the United States Circuit Court is most important, as it makes valueless a patented device which has been used solely in a business not recognized by law. The plaintiff lost his case "in view of the lack of legal utility of the patented device." The case in point was a patented bogus coin detector used in slot machines operated for gambling purposes. The decision by Judge Kohlsatt deprives the owner of the patent of standing in a court of equity to sue any man for alleged infringement on the device. The judge held that the patent in this case was not useful to the world in general and that the patent rights therefore could not be protected.

Obituary Notices

VOLNEY G. BARBOUR, for 31 years professor of civil engineering in the University of Vermont, died on June 4 in Minneapolis, Minn.

SIR COURTENAY BOYLE, permanent secretary to the Board of Trade, London, England, died recently from heart failure. He was born in Jamaica in 1845, and was the eldest son of the Hon. Cavendish Spencer Boyle, grandson of the seventh Earl of Cork. From 1868 to 1873 Sir Courtenay was private secretary to the Viceroy of Ireland, and again from 1882 to 1885. He was created a C. B. in 1885 and K. C. B. in 1892. His name is one to be remembered in connection with the passing of the Railway and Canal Act in 1894, and other legal matters of importance. In 1890-1891 he served with Lords Rayleigh and Kelvin on the Electrical Standards Committee, and in July, 1898, was an active member of the committee which considered, under the chairmanship of Lord Rayleigh, the advisability of forming a national physical laboratory. His last work was the amendment of the rule which originally gave the consumer power to prevent a complete change over to higher voltages in electric lighting undertakings, the decision having been rendered by the courts only a week or two ago.

Electric Railways

Construction work is to be begun within a week on the lines of the Genesee, N. Y., & Orleans Railway Company.

A new 1,000-horse-power generator and 80 new cars are to be installed by the Toronto, Quebec, Railway Company during the coming summer.

A mortgage of $200,000 has been filed by the Hamburg, N. Y., Railway Company to secure an issue of bonds for the extension of its system.

A franchise is wanted by the promoters of the Salt Lake City, Utah, Railroad for permission to run cars along the west bank of the Jordan Canal.

Contracts for the construction of the standard gauge electric railway between Tacoma and Seattle, Wash., have been awarded and work has begun.

New car shops are soon to be built in Rochester, N. Y., by the Rochester Railway Company. The plans call for a one-story building, 173 feet wide and 200 feet long.

Construction work on the lines of the Richmond & Petersburg, Va., Electric Railway Company, has been delayed by bridgework, but construction work has at last begun and will be rapidly pushed.

Construction work is to be begun on the lines of the Louisville, Ky., Mount Washington & Fairfield Electric Railway Company within the next month. Messrs. J. C. Mays and J. C. Wright, of Lexington, are both interested.

Extensive improvements to its power plant at New Haven, Pa., have been begun by the Pittsburgh, McKeesport & Connellsville Street Railway Company. A permanent plant will be located at Valley, and is to be erected within a year.

It is officially announced that when the through trolley line between Hartford and Springfield is completed, the running time between the two cities will be an hour and a half, and the fare 30 cents. The distance is about 30 miles.

A five-mile extension, which will be built at a cost of $800,000, is to be made by the Monongahela, Pa., Street Railway Company and the Wilkinsburg & East Pittsburgh Railway. The extension will run from East Pittsburgh to Pitcairn.

The new electric street railway in Athens, Ga., will soon be under construction. Rails and other traction material have already arrived and as soon as repairs to the city's sewer system are completed, traction work on the railway will be begun.

A new street railway company has been organized in Richmond, Ind., and will be known as the Richmond Street and Interurban Railway Company. The directors are: H. F. McGowan, James Murdock, J. M. Lentz, P. J. Freedman and others.

Permission has been granted by the common council of Niagara Falls, N. Y., to the Niagara Falls Suspension Bridge Railway Company for the construction of a loop line through Prospect and Niagara streets to the riverway. This means access to the park.

It is reported that Boston capitalists, among whom are Messrs. H. M. Bates and T. E. Cleary, have secured a controlling interest in the Buffalo, N. Y., Gardenville & Ebenezer Electric Railroad Company, and will assume formal possession on June 1.

Reports from Michigan state that the Detroit, Plymouth & Northville Electric Railway has been sold to the Boland-Flynn Syndicate for $250,000. The syndicate is stated to have been incorporated recently under the name of the Detroit & Chicago Railway Company.

Certificates of mortgage or joint bond of $1,000,000 on their Twin City property of the Minneapolis and St. Paul street railways has been filed at Minneapolis, Minn. The mortgage has been issued for the purpose of making general improvements during the coming summer.

El Paso, Tex., is soon to have an electric street railway and the present mule-car system will soon be only a remembrance. It is reported that two companies are negotiating for the franchise, and that a forfeit of $5,000 has been posted for the successful carrying out of the project.

The Detroit & Toledo Short Line Company and the Toledo & Detroit Shore Line Company have been consolidated by the Everett-Moore Syndicate, of Cleveland, Ohio, the object of the syndicate being to avoid competition between the two roads. The merger involves some $800,000.

Mr. A. M. Young, of New York, and Mr. Horace E. Andrews, of Cleveland, Ohio, have purchased the electric railway interests of Utica, N. Y., and intend to develop them and extend the system throughout the territory adjacent to that city. This important field includes about 100,000 inhabitants.

A franchise has been granted in Charleston, S. C., to the Exposition Traction Company, which will build a trolley line from the city into the exposition grounds. Messrs. P. H. Gadsden and others, who control the Charleston Consolidated Company, are interested in the new enterprise, which is to be completed by July 1.

A new organization has been perfected in Dundee, N. Y., and will be known as the Dundee, Tyrone & Bradford Railroad Company, with a capital stock of $16,000, subject to increase. Officers of the company are: President, G. P. Lord; vice-president, Cyrus Munson; secretary, E. M. Sawyer, and treasurer, S. H. Harpending.

A charter has been granted to the Williamsport & Lock Haven, Pa., Traction Company, which will operate a trolley line by way of Jersey Shore and Oak Grove to Lock Haven. The company is capitalized at $150,000, and has the following directors: Hon. H. C. McCormick, S. T. McCormick, W. B. Given, J. A. Scott and others.

The Los Angeles, Cal., Traction Company is renewing its efforts to build up a complete interurban system auxiliary to its local lines, and has formed two companies with that object in view. Both corporations have an aggregate capital of $1,750,000. The traction company desires to reach the foot hills at Pasadena and tide water at San Pedro.

The plans of the gentlemen who are projecting a big power station for Wickford, R. I., have been carried out and sufficient electricity will be generated to furnish electric power for the Seaview Railroad, and also for the future extension of the road. As soon as the projected plan is completed the present power station at Narragansett Pier will be done away with.

By a recent vote of the directors of the Rochester, N. Y., Railway Company, the first step toward improving the car system in that city was taken by making a provision for the raising of $1,000,000, which will be devoted to the proposed improvements of the line. The company announces a general plan for the betterment of its service and the increase of its efficiency.

An electric line, which will run from the Sacramento River to the Bully Hill lines, connecting there with the Pacific steam lines, is projected in California, and it is stated that the Fair and Crocker estates are interested in the proposition. When built the road will be standard gauge and 12 miles in length. It is also reported that a company has been organized and the start fairly made.

It is stated that the Cincinnati, Ohio, Traction Company has bought all the lines operating across the Ohio River, and President Hugh McGowan, of the Cincinnati Company, recently admitted in Indianapolis that negotiations are pending for the consolidation of the lines on both sides of the Ohio River at Cincinnati, but that control of the Newport and Covington systems had not as yet been obtained.

Consolidation rumors are in the air in Ohio and it is stated that the entire street railway system of Toledo is likely to pass into the control of the Everett-Moore Syndicate, of Cleveland, before the middle of August. President Lang, of the Toledo Traction Company, on June 1 admitted that his road had been asked for a price and that the request had been complied with, but stated that the road had not been purchased.

A new station is to be erected in Chicago, Ill., for the Lake Shore, Rock Island and Nickel Plate railroads. A $3,000,000 terminal will be erected and construction work is to be begun in the fall. When completed the building will be 10 stories high and all trains, it is planned, will be hauled in and out of it by electric motors, the trains of the Lake Shore & Michigan Southern and the New York & St. Louis railroads dropping their engines at Englewood.

The Long Island Extension Railroad Company has been organized. It is to operate by electricity or other power a tunnel railroad from Long Island City to a point near Forty-second street and Broadway, New York city. The capital stock is $1,000,000. The directors are Dumont Clark and William H. Baldwin, Jr., of New York city; Thomas DeWitt Cuyler, of Haverford, Pa.; C. Stuart Patterson and S. M. Prevost, of Philadelphia; John P. Green, of Rosemont, Pa.; William A. Patton, Radnor, Pa.; Charles E. Pugh, of Overbrook, Pa.; Samuel Rea, of Bryn Mawr, Pa.

Pleasure resorts on the Canadian side of the Niagara River are soon to be connected with Buffalo by trolley and quick service is promised between that city, Fort Erie, Crystal Beach, Niagara Falls and the Fort Erie race track by the International Traction Company, which was recently incorporated in Delaware, and which is taking the property and franchises of the International Ferry and Fort Erie Railway companies. Mr. T. C. Frenyear, resident manager in Buffalo of the Westinghouse Manufacturing Company, is president of the new organization, and Mr. M. W. Comstock, of Buffalo, is vice-president and counsel.

A decision has been recently rendered by the Supreme Court of New Jersey, deciding the case of Mayor and Aldermen in New Jersey against the North Jersey Street Railway Company, the court holding that railway franchises in New Jersey are taxable as real estate. This decision gives several million dollars annually to the state revenues and is considered a most important point, as it affects every city, township and borough through which an electric trolley road passes. It is believed that it may possibly prevent the construction of several of the small trolley lines for which franchises have already been granted. Lawyers state that the decision is very sweeping in its scope, and the contracting municipality is already refusing to allow any company to string its wires or lay gas mains, for pipe and conduit are taxable as real property.

Telephone and Telegraph

Arrangements are being made by the Central Union Telephone Company for the reconstruction of its plant in Fostoria, Ohio, at an expense of $20,000.

It is reported that the state government of Mexico has authorized the application of the municipal rents for the construction of a telephone line from Zacazonapan to Valle de Bravo.

The board of Highway Supervisors of Philadelphia has granted permits to the Keystone Telephone Company to lay main conduits on a number of the leading streets of that city. The board also granted permits for about 30 streets for branch conduits.

Amended articles of incorporation have been filed at Lansing, Mich., by the Citizens' Telephone Company, of Grand Rapids, increasing its capital stock of $550,000 to $1,000,000. The company is likely to extend its copper long-distance wires to Manistee by July 15.

A new telephone exchange is being erected in St. Paul, Minn., by the Twin City Telephone Company, and it is thought that it will be in operation by September 1. The switchboard will have an ultimate capacity of 6,400 lines and with the substation at Bale street the company will be enabled to handle 10,000 telephones in the city.

The Missouri & Kansas Telephone Company, Kansas City, Mo., of which John R. Mulvane is president, N. R. Ferguson, secretary and treasurer, and Alonzo Burt, general manager, reports a very successful year for 1900. An excellent surplus remains after paying quarterly dividends at annual rate of six per cent. The demand for telephones and toll lines is such that the company has decided to issue 7,755 shares of the capital stock of the company at par. Stockholders of record June 29, 1901, will be entitled to one share of the new stock for every two of the old. The right to subscribe will expire at the close of business on Monday, July 1, 1901. This company is a very ably, yet conservatively, managed organization, and the new issue of stock will undoubtedly be taken promptly by the present stockholders.

Several changes have occurred in the personnel of the Chicago and Central Union Telephone companies since Mr. John I. Sabin, of San Francisco, came to Chicago and assumed the presidencies of these two organizations. The officers of the Central Union Telephone Company are: President, John I. Sabin; general manager, M. J. Carney; secretary and treasurer, W. S. Chapman; auditor, E. G. Corneau; general solicitor, L. G. Richardson, and superintendent of construction and maintenance, Robert Cline. The following appointments took effect June 1: Private secretary to president, John A. Mallon; assistant general manager, George B. Bush; engineer, A. J. Steiss; superintendent of equipment, F. W. Alston; electrician, S. G. McMeen; general canvassing agent, C. E. Nestor, and assistant auditor, E. G. Drew. The office of general superintendent was abolished. The officers of the Chicago Telephone Company are: President, John I. Sabin; first vice-president, Byron L. Smith; second vice-president, Arthur D. Wheeler; general manager, A. S. Hibbard, and secretary and treasurer, C. E. Mosley; chairman of the board of directors, John M. Clark. The board consists of Byron L. Smith, J. Russell Jones, Robert T. Lincoln, Arthur D. Wheeler, A. A. Sprague, Chauncey Keep, John I. Sabin, C. E. Perkins, Joseph P. Davis, and Alexander Cochrane. The president has appointed as engineer, A. J. Steiss; superintendent of equipment, F. W. Alston, and general canvassing agent, C. E. Nestor.

Personal Mention

MR. W. K. VANDERBILT was recently elected a life member of the Automobile Club of France.

MR. A. J. McDONALD has recently been appointed general superintendent of the street railway system of the city of Mexico.

MR. EDWARD B. GUNN, late superintendent of the Lafayette Street Railway Company, has been appointed superintendent of the Richmond, Ind., Street and Interurban Railway.

MR. F. L. WAUKLYN, the late manager and chief engineer of the Montreal, Quebec, Street Railway Company, has accepted the managership of the Montreal Power Company.

CAPTAIN WILLIAM BROPHY, formerly of the Boston wire department, recently resigned from the service, and has been doing expert work for the Boston Edison Company and others.

MR. ARTHUR HALE, of Philadelphia, superintendent of telegraph of the Pennsylvania Railroad, has been appointed assistant general manager of the Baltimore & Ohio Railroad Company.

DR. E. A. ENGLE, professor of mathematics at the Washington University, St. Louis, Mo., and Dean of the College of Engineering recently, has been elected president of the Worcester, Mass., Polytechnic Institute.

MR. A. H. HEYWARD, late consulting engineer of the Buenos Ayres & Belgrano Railway Company, was recently a New York visitor. Mr. Heyward is en route to San Juan, Porto Rico, where he will manage the local lighting and tramway company for Messrs. J. G. White & Company, of New York.

MR. ARTHUR STEIN, secretary of the Eureka Electric Company, Chicago, Ill., accompanied by Mrs. Stein, was a visitor at the Netherlands Hotel, New York, during the past week. Mr. and Mrs. Stein were on their way from the Pan-American Exposition and are making quite an extended trip through the country.

MR. WILLIAM C. B. VAN DYCK, instructor in electrical science at Rutgers College, had tendered his resignation to the board of trustees. He is said to be interested in an electrical company in this city, and leaves Rutgers so as to be able to more fully look after his duties here. Mr. Van Dyck is a son of Professor F. C. Van Dyck, of Rutgers.

MR. FRANK C. MASON, superintendent of police telegraph, Brooklyn, N. Y., has just received a letter from William C. Ergenzinger, of Candow, Luzon, P. I., asking for a copy of the paper he read before the fire and police telegraph superintendents on "The Progress and Needs of the Fire and Police Departments." Mr. Ergenzinger expects employment in the reorganization of the police in Luzon Island, and he wants to post himself through the aid of Mr. Mason's experience.

MR. EDWARD A. LESLIE has accepted the position of general manager of the Kings County Electric Light and Power Company, of Brooklyn, N. Y., which operates the Edison Illuminating Company and other electric lighting companies of that city. Mr. Leslie is a very active, intelligent and broad-gauged electric light man, and his administration of the affairs of this important company will undoubtedly be of the most successful and enterprising nature. He succeeds Mr. W. S. Barstow, who retires to assume other duties.

Electric Lighting

Bids are soon to be asked by the People's Light Company, of Reading, Pa., for an electric lighting plant of 20,000 horse-power.

A large electric lighting plant is soon to be erected at Union, N. J., to supply that township and towns in the vicinity of Elizabeth.

A new substation will be built by the Citizens' Gas and Electric Light Company, of Omaha, Neb., near the company's present office at a cost of between $15,000 and $20,000. It is reported that the controversy between the company and a motor company of the city regarding pole rentals has been amicably settled.

A power-house and office building are to be constructed by the Metropolitan Electric Light Company, of Reading, Pa., in the Exchange Hotel in that city, which the company has recently purchased. Within the year the hotel will be altered into an addition to the present power-house. Extensions and improvements will be made to the company's incandescent system.

The contract for the two new dynamos and the installation of the new electric light plant at the pumping station, in Bangor, Me., has been signed, and the installation of the new plant will be begun at once. By this plant power will be furnished for 300 additional arc lights and for 2,000 of the incandescent lamps which, latter, will be used in the illumination of the city buildings.

In order to absorb the Redlands Electric Light and Power Company, which supplies the territory in Redlands and Riverside, the Los Angeles, Cal., Edison Electric Company has increased its capital stock from $1,250,000 to $2,000,000. Mr. H. H. Sinclair has resigned as president and manager of the Redlands company, and will be succeeded by an Edison stockholder not yet determined upon. Among the directors of the Edison company are Messrs. Fisher, Sinclair and Miller, and other California capitalists.

The Citizens' Light Company was incorporated in Louisville, Ky., recently, for the purpose of consolidating the People's Electric Light Company, the Citizens' General Electric Company, and other public utilities which may hereafter be deemed desirable. The capital is $1,000,000. Among the stockholders are: Joseph B. Mayer, Buffalo; Charles A. Collin, Brooklyn; Charles J. Farrell, Mount Vernon, N. Y.; Thomas E. Murray, William F. Sheehan, A. N. Brady and John E. Barne, all of New York; Charles R. Huntley, Buffalo; L. B. Grant, John S. Wells, Brooklyn, and Charles H. Werner, New York.

By the incorporation recently of the Syracuse, N. Y., Lighting Company, the first step was taken in the proposed plan for merging the Syracuse Gas and the Syracuse Electric Light and Power Company. The capital stock of the new organization will be $2,500,000, and is less than the capital stock issued by the two old companies. All of the outstanding bonds are to be called in and a new issue will be made, so that all such securities, which now cover separate properties, will be on an equal footing and cover all property of the new company. John J. Cummins will be general manager of the new company, one or both the presidents of the old companies will resign. The ownership of both companies is in practically the same hands, the principal owners being Messrs. William L. Elkins, Jr., of Philadelphia; Stephen Peabody and Henry Seligman, of New York; Robert C. Pruyn, of Albany, and John Dunfee, of Syracuse.

New Incorporations

ELMIRA, N. Y.—Citizens' Telephone Company. $250,000.

NELLISTON, N. Y.—Mohawk River Traction Company. $160,000.

ELKHART, IND.—Farmers' Mutual Telephone Company. $5,000.

NORWALK, OHIO—Buckeye State Telephone Company. $10,000.

NAPOLEON, OHIO—Napoleon Home Telephone Company. $50,000.

SHADE, ATHENS COUNTY, OHIO—Jerseyville Telephone Company. $3,000.

SPRINGPORT, MICH.—Springport Telephone Exchange Company. $500,000.

LISBON, OHIO—Salem, Lisbon & East Liverpool Traction Company. $10,000.

TROY, OHIO—Troy Telephone Company. Capital increased from $40,000 to $75,000.

JEFFERSON CITY, MO.—Western Electric Company. Capital in Missouri, $100,000.

CLEVELAND, OHIO—Cleveland, Wadsworth & Southern Electric Railroad. $10,000.

CHARLESTON, W. VA.—West Fork Traction Company. $250,000. Incorporators not named.

EAST JORDAN, MICH.—East Jordan Electric Light and Power Company. $10,000.

DES MOINES, IOWA — Des Moines, Nevada & Eldora Electric Railway Company. $50,000.

ELMIRA, N. Y.—Elmira Telephone Company. Capital increased from $40,000 to $150,000.

ADAIR, IOWA—Adair Telephone Company. $10,000. Incorporators: L. H. Paine and others.

SAULT STE. MARIE, MICH.—Soo-Detour Railway Company. $500,000. Incorporators not named.

NEW YORK CITY, N. Y.—International Electric Syndicate. $500,000. Incorporators not named.

TRENTON, N. J.—New Jersey Power Storage Company. $100,000. Incorporators not named.

LA PORTE, IND.— The La Porte Telephone Company has increased its capital stock to $20,000.

SIDNEY, OHIO—Sidney Telephone Company has increased its capital stock from $30,000 to $60,000.

VERMONT, ILL.—Tazewell County Telephone Company. Capital increased from $2,500 to $10,000.

COLUMBIA CITY, IND.—Home Telephone Company. Increased its capital stock from $10,000 to $25,000.

MONMOUTH, ILL.—Monmouth Telephone Company. Capital stock increased from $35,000 to $50,000.

PIQUA, OHIO—Piqua Home Telephone Company. Increase of capital stock from $75,000 to $100,000.

NEWARK, N. J.—Newark Motor Vehicle Company. $100,000. Incorporators: T. K. Irving and H. C. Hess.

DUMARS, ARK.—Arkansas River Telephone Company. $6,000. Incorporators: W. A. Cheshire and others.

LAKE CREEK, TEX.—The Southern Telephone Company has increased its capital stock from $4,000 to $8,000.

ROCHESTER, N. Y.—Wheeler-Green Electric Company. Capital, $4,000. Directors: Clarence Wheeler and others.

CADIZ, OHIO—The Harrison County Telephone Company has increased its capital stock from $25,000 to $50,000.

PEKIN, ILL.—Citizens' Telephone Company. $50,000. Incorporators, J. M. James, L. W. Bennett and E. R. Peyton.

EAST LIVERPOOL, OHIO—Wellsville Electric Light Company. Increase of capital stock from $30,000 to $100,000.

CAPE MAY, N. J.—Cape May Electric Company. $100,000. Incorporators: T. Robb, L. M. Bullitt and J. M. E. Hildreth.

INDIANAPOLIS, IND.—Waveland Telephone Company. $1,000. Shannondale Cooperative Telephone Company. $600.

FORT MADISON, IOWA—German-American Telephone Company. $1,600. Directors: A. L. Powell, Franz Schubert and others.

NEW YORK CITY, N. Y.—East Jersey Light and Power Company. $250,000. Incorporators: A. M. Mead, G. Holmes and others.

NEW YORK CITY, N. Y.—General Tunnel Engineering Company. $100,000. Directors: W. H. Knight, D. J. Newlans, F. M. Laude.

ATHENS, N. Y.—Upper Hudson Electric Company, of Green County. $100,000. Directors: W. O. Turner, E. Wolfe and N. W. Dalton.

FORT WORTH, TEX.—Citizens' Light and Power Company. $100,000. Incorporators: D. T. Bonner and G. E. and R. I. White.

CONCORD, N. H.—Concord Electric Company. $400,000. Incorporators: William H. Whitney, C. H. Stone, G. L. Osgood and others.

LA SALLE, IND.—Enterprise Light, Heat and Power Company. $25,000. Incorporators: T. W. Lucey, G. A. Wilson and W. R. Hummer.

NEW MARKET, N. H.—The New Market Electric Light, Power and Heat Company has increased its capital stock from $10,000 to $22,000.

ELIZABETH, ILL.—Jo Daviess County Metal Telephone Company. $2,500. Incorporators: William Skine, Ernest Stadel and others.

GRANITE CITY, ILL.—Granite City & Everettsville Railroad Company, of Venice. $60,000.. J. A. Jenne, E. L. McFadden and E. W. Link.

WATERTOWN, N. Y.—Watertown & Carthage Traction Company. $200,000. Directors: A. S. Fairchild, J. T. Hollister, S. S. Luther and others.

CHICAGO, ILL.—Duncan Electric Manufacturing Company. $100,000. Incorporators: Charles A. Brown, George L. Cragg and Harvey L. Harrison.

DETROIT, MICH.—People's Telephone Company. $2,500,000. Incorporators: Henry A. Everett, Edward W. Moore, T. D. Buhl, J. W. Martin and others.

HADDONFIELD, N. J.—Tuckerton Electric Company. $10,000. Incorporators: Ezra C., John H. and Edwin R. Bell, M. W., T. F., J. W. and A. E. Pharo.

BRIGHTON, N. Y.—Monroe County Electric Belt Line Company. $250,000. Incorporators: A. J. Grant, A. H. Bown, C. J. Brown, W. A. Parce and others.

NEW YORK CITY, N. Y.—Gowdy, McLean & Company, to manufacture electrical machinery. $300,000. Incorporators: E. E. Gowdy, R. McLean and S. W. Miller.

TAMPA, FLA.—Tampa Bay & East Coast Railway Company. $50,000. Incorporators: R. G. Rehtt, president; T. W. Haskell, secretary, and T. M. Ware, treasurer.

NEW YORK, N. Y.—Spencer Electrical Company. $100,000. Directors: J. H. Spencer, New York city; C. L. Child, Montclair, N. J.; Henry Dawson, Richmond Hill, L. I.

GENEVA, ILL.—Joliet, Plainfield & Aurora Electric Railway Company. $50,000. Incorporators: Ed. Fisher, M. H. Mottinger, S. E. Godard, W. H. Heun, Eneshia Meers, of Joliet.

CLEVELAND, OHIO—Xenia & Wilmington Traction Company. $5,000. Incorporators: Charles Orr, Eckstein Case, C. J. Dockstader, H. M. Yost, W. E. Sage and J. P. Martin.

DES MOINES, IOWA—Marengo Telephone Exchange; $7,500; incorporators: Orson Eddy, Henry Gode and others. Northern Iowa Telephone Company; capital increased to $40,000.

MINNEAPOLIS, MINN. — Minneapolis & Anoka Railway Company. $200,000. Incorporators: John J. Elliott, Arthur W. Selover, E. H. Fuller, George H. Selover and William Williamson.

WATKINS, N. Y.—Watkins Consolidated Electric and Gaslight Company. $100,000. Directors: A. R. Horn, Catasauqua, Pa.; J. J. McKee, Bethlehem, Pa.; Charles B. Reed, New York city.

YOUNGSTOWN, OHIO—Sharon & New Castle Electric Railway Company. $380,000. Incorporators: Hon. Randall Montgomery, S. D. L. Jackson, George E. Rose, James Kennedy and Thomas E. Connell.

CLEVELAND, OHIO — Manhattan Construction Company. To maintain an electric railroad construction business. $10,000. Clement McMahon, Jr., S. B. Newman, S. G. Moore, F. A. Fallin, C. E. McKisson.

ALBANY, N. Y.—New York & Richmond Gas Company. To manufacture and supply gas and electricity for lighting purposes. Directors: Armitage Mathews, R. C. McCormick, Hawkins A. Tucker and others. $1,500,000.

TOLEDO, OHIO—Toledo & Indiana Railway Company. Incorporators: Hon. Charles P. Griffin, A. K. Detwiler, C. H. Masters, James Donnelly, John J. Barker, of Toledo, L. W. Brown, J. Q. Files and John C. Rorick, of Wauseon.

ST. LOUIS, MO.—Gasconade Railway Construction Company; $50,000; incorporators: T. W. Murphy, D. R. Francis, Jr., and others. Halls Ferry & Des Pres Belt Line Railroad; $50,000; incorporators: P. H. Griffin, C. F. Quick and John Layman.

CORTLAND, N. Y.—Cortland Traction Company. $320,000. Directors: C. D. Simpson and Wm. B. Blair, of New York city; Herman Bergholtz, of Ithaca; B. F. Taylor, Hugh Duffy, Edwin Duffy and E. H. Brewer, of Cortland, and others.

JERSEY CITY, N. J.—Auto Coupler and Supply Company. To manufacture electrical supplies. $100,000. Incorporators: James Westervelt, Henry B. Gayley, George W. Flaacke, Jr. Ewart Railway Supply Company. To manufacture electrical supplies. $24,000. Same incorporators.

Electrical Securities

The decrease in the surplus of the national banks of New York brought it below the $7,000,000 mark—the lowest figure in any week but one of the present year. It is not thought on the street or by the leading bankers, however, that there will be a tight money market, but that instead hereafter rates will be easier. The dividend disbursements of July 1, 1901, it is estimated, will exceed $100,000,000, and will be the greatest in the history of the country.

All this money will seek reinvestment and the opinion of the best financiers is that this new demand must necessarily be followed by a higher market.

ELECTRICAL SECURITIES FOR WEEK ENDING JUNE 22.

New York:	Highest.	Lowest.	Closing.
B'klyn R. T.	83⅜	82⅛	82⅛
Con. Gas	222½	222	222
Gen. Elec	260	260	260
Man. El.	125⅝	124⅛	125⅛
Met. St. Ry.	175⅛	174⅛	174⅛
Third Ave. R. R.	122	122	122
Kings County Electric	...	...	205
N. Y. & N. J. Tel. Co.	...	...	177
Telep., Tel & Cable Co.	...	...	6¼

The American Telephone and Telegraph Company has made an application to have listed on the New York Stock Exchange the following: $15,000,000 four per cent collateral trust bonds of 1929, and $114,946,000 of capital stock.

The financial situation in this city is considered to be very good. A recent straw is to be noted in the declaring by the National Park Bank, one of the great financial institutions of the city, of a semi-annual dividend of seven and one-half per cent, which is an increase of one and one-half per cent, the preceding payment having been six per cent.

The Hall Signal Company has declared the regular quarterly dividend of one per cent on the common stock, payable July 1, 1901.

Metropolitan Street Railway Company has declared the regular quarterly dividend of one and three-quarters per cent, payable July 15, books closing June 26.

It is announced that the Otis Elevator Company has purchased the Sprague Elevator Company, thus taking over the entire elevator business formerly conducted by the Sprague Electric Company. Both companies have been doing a large business.

The Central & South American Telegraph Company has declared the regular quarterly dividend of one and one-half per cent, payable July 9.

The Mexican Telegraph Company has declared the regular quarterly dividend of two and one-half per cent, payable July 1.

The United Traction and Electric Company has declared the regular quarterly dividend of one per cent on the capital stock, payable July 1. Books closed June 18 and reopen July 2.

Boston, June 22:	Closing.
Am. Tel. and Tel.	160
Erie Tel.	55
New Eng. Tel.	142
Mass. Elec. pf.	93⅛
Westing. Mfg. pf	70½
Edison Elec	260

The vetoing of the subway bill by Governor Crane is looked upon as being against the interests of the Boston Elevated.

The directors of the American Telephone and Telegraph Company have declared the regular quarterly dividend of 1½ per cent and ¾ per cent extra. This dividend is payable July 15 to stock of record of June 29. At the same meeting the resignation of Mr. Alexander Cochrane, who has been president *pro tem*, was accepted to take effect June 30, and Mr. Frederick P. Fish was elected to asume office July 1, 1901.

The Boston Electric Light Company has declared the regular quarterly dividend of two per cent and one per cent extra, payable August 1, 1901. Books close June 29.

Philadelphia, June 22:	Closing.
Elec. Co. of A.	8⅛
Philadelphia Elec	5⅝
Union Traction	26
United G. I. Co.	119
Elec. S o. Bat. c.	70
Elec. Sto. Bat. pf.	70

Mr. John Wanamaker, of Philadelphia, offered $2,500,000 for the street railway franchises which the city of Philadelphia granted to other interests without remuneration. The non-acceptance of Mr. Wanamaker's offer, which was accompanied by a cash deposit of $250,000, has caused considerable discussion and criticism in Philadelphia. Mr. Wanamaker later offered an additional $500,000 to the owners of the franchises, his offer to the city to stand.

Electric Storage Battery was strong during the week. At one time the common advanced 14 points to 66, and the preferred 7½ to 62½. Dividends at the rate of five per cent per annum have been paid this year on both issues. The earnings last year were eight per cent on the stock, and it is thought likely the dividends will be increased to six per cent this year. Shareholders are said to be getting over their scare about the new Edison battery, and therefore are retaining their stock. The company declared regular dividends on both common and preferred stocks of one and one-quarter per cent for the quarter ending June 30.

Philadelphia Electric was bullish throughout the greater part of the week. There was also a good demand for Electric of America. Union Traction was dull but steady around 26.

There is an organized opposition to the combination of Electric Company of America and American Railways. It is announced that a new plan will be offered to substitute for the one formulated by the boards of the two companies. The opposition is said to represent between 40,000 and 50,000 shares.

Chicago, June 22:	Closing.
Chicago Edison Light	200
Central Union Telephone	38
Chicago Telephone	275
Un. Trac.	19¾
Un. Trac. pf.	58½
Metropolitan El.	92

Union Traction was active, advancing to 20 on purchase of something over 2,200 shares.

There is considerable gossip here in regard to the dividends on the common stock of U. S. Steel Corporation. Information from New York is to the effect that common stock would be placed on a four per cent dividend basis. There is no doubt here about the ability of the company to pay a good dividend on the common stock for the earnings have been very large.

Central Union Telephone still furnishes considerable discussion since President Sabin's announcement of the immediate need of $3,000,000 and a request for a voluntary assessment of $60 per share. President Sabin is confident that the funds will be furnished and that when the extensions have been completed the property will begin to return substantial dividends. A large number of new subscribers have already been secured at Indianapolis and other important centres of the company's territory.

Large purchases are reported of People's Gas here, which, it is thought, will soon absorb the Chicago Edison.

President Insull of the Chicago Edison Company says:. "While our stock has been increased $4,000,000, we shall issue only $900,000 to stockholders at par about August 1. The other $3,100,000 will remain in the treasury for use as the extension of business demands. This authorization gives the board of directors the right to issue new stock from the treasury at its option, but it will be put out only on needed improvements."

Automobile Notes

During the forthcoming military manœuvres in England 22 automobiles and motor-driven bicycles will be pressed into service for transporting the officers of the general staff and despatches.

The London, England, Fire Department is experimenting with various types of automobiles, in order to replace mechanical traction throughout in all of its equipment of engines, hose carts, etc.

The colonies of New South Wales and Queensland have both decided to use automobiles for the transportation of mails, especially in the arid districts of the interior, where horse transportaion is very costly.

It is reported that the French War Office is carrying on negotiations by which the majority of French automobiles now in use may be obtained for army service in the event of mobilization, and preference is said to be shown by the General Staff for covered or closed vehicles which will be identified with the general transport service.

The registration blank which is shown below is the one which has been approved recently by the Secretary of State of New York, and has been furnished to all the members of the Automobile Club of America who own machines. Only one vehicle may be registered on each certificate:

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CERTIFICATE OF OWNER OF AUTOMOBILE.

Name.....
Address .....

DESCRIPTION OF VEHICLE.

Trade Name.....
Style .....
Seating Capacity.....
Motive Power.....
Factory Number.....
Made By.....
Dated.....

The 500-mile test of the Automobile Club of America will begin on Monday, September 7, between the cities of Buffalo and New York. The classes of vehicles which will be permitted to enter, and the different stages of the run, one stage being run on each of the six days, are: Under 1,000-pound class—Four-wheeled motor vehicles weighing under 1,000 pounds, in commercial running and operating condition, with tools, fuel, and supplies on board. 1,000 to 2,000-pound class—Four-wheeled motor vehicles weighing between 1,000 and less than 2,000 pounds, in commercial running and operating condition, with tools, fuel, and supplies on board. 2,000-pound or over class—Four-wheeled motor vehicles weighing 2,000 pounds or over, in commercial running and operating condition, with all tools, fuel, and supplies on board. Motor cycle class—Motor bicycles, motor tricycles, and motor quadricycles. Public service class—Public conveyances and freight conveyances. These shall carry a minimum weight of 750 pounds, exclusive of their driver. First stage—From clubhouse to Poughkeepsie; approximate distance, 90 miles. Second stage—From Poughkeepsie to Albany; approximate distance, 70 miles. Third stage—From Albany to Little Falls, including a hill-climbing trial near Little Falls; approximate distance, 85 miles. Fourth stage—Little Falls to Syracuse; approximate distance, 85 miles. Fifth stage—Syracuse to Rochester; approximate distance, 90 miles. Sixth stage—Rochester to Buffalo; approximate distance, 80 miles. The contest is open to all classes of self-propelled vehicles, but no manufacturer, agent, or private owner will be allowed to enter more than three vehicles in any one class.

Industrial Items

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has just issued bulletin No. 4245, on "Switch System of Remote Control." This is an interesting leaflet, well illustrated, describing in detail the switch system.

THE ELECTRIC APPLIANCE COMPANY, Chicago, is putting out a new dry battery under the well-known name "Eaco," which this company especially recommends for telephone work, and where heavy service is required.

THE NORTH ELECTRIC COMPANY, Cleveland, Ohio, manufacturer of telephone apparatus, is distributing to its patrons a good-luck penny, accompanied by some literature descriptive of North telephones and switchboards.

THE SMITH & HEMENWAY COMPANY'S exhibit and also the exhibt of the Utica Drop Forge and Tool Company are to be seen at the Pan-American Exposition, in section F of the Electricity Building, in Marland's collective exhibits.

THE ELECTRIC APPLIANCE COMPANY, Chicago, manufactures the Eaco visual signal switchboard, which it claims has all of the advantages of the flashlight board without the aggravations caused by the burning out of the signal lamps.

HYLO LAMPS are carried in stock by the Central Electric Company, of Chicago. This is a double filament regulating lamp which is being advertised extensively. Besides being economical, it is found very convenient as an all-night light in halls, bathrooms, sickrooms, etc.

THE EUREKA ELECTRIC COMPANY, Chicago, Ill., distributed at the telephone convention a very unique souvenir in the shape of a magneto transmitter. The transmitter was designed as a watch charm, and was a reproduction of the well-known Eureka transmitter.

THE STANDARD SAFETY BOILER COMPANY, Marquette Building, Chicago, is sending out a leaflet containing many kind endorsements of the Standard boiler, and also calling attention to its many features of excellence. This boiler has a number of users in electrical circles.

G. E. LINTON & COMPANY, of Worcester, Mass., has recently moved its factory to 25 Hermon street, purchasing a lot of new tools, and increasing the company's facilities. This company manufactures electrical specialties, such as panel boards, tablet boards, switchboards and switches.

THE ALLIS-CHALMERS COMPANY, Milwaukee, will be the name hereafter used in place of the Edward P. Allis Company, Fraser & Chalmers, Gates Iron Works and Dickson Manufacturing Company. The general offices of the company will be in Chicago, on the tenth floor of the Home Insurance Building.

THE LEA ELECTRIC MANUFACTURING COMPANY, of Elwood, Ind., is sending out a neat, illustrated souvenir. It presents a practical idea of the Northall swinging cover of its enclosed arc lamp. This company's exhibit at the Pan-American Exposition consists of its standard enclosed arc lamps, miniature enclosed arc lamps, automatic arc headlight, etc.

POPE & CUSHMAN, West Twenty-third street, New York, are calling attention to their new Fanning electric runabout, using the Porter storage battery. The special feature of this carriage is ease of riding, which is obtained with a flexible running gear composed of ball and socket joints taking up the vibration and giving long life to the vehicle.

THE CENTRAL ELECTRIC COMPANY, of Chicago, has issued a new wire price list, dated June 17, in which is listed I. X. L. weatherproof wire, galvanized telephone wire, annunciator, office and magnet wires and lamp cord. This company will be glad to receive inquiries from those interested in this material and will be pleased to send copy of price list upon request.

THE LANE & BODLEY COMPANY, Cincinnati, announces the fiftieth anniversary of the life of the company. The leaflet announcing this carries a picture of an engine built by the company in 1851, and also in contrast an illustration of an engine built by the same company in 1901. This half century of existence has been a very successful one, and the many friends of the Lane & Bodley Company will extend congratulations.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, 70 to 82 West Jackson Boulevard, Chicago, Ill., has recently established a new eastern office at Pittsburgh, Pa. The office is located at 124 Liberty street, and will be under the management of Mr. John L. Brown, who is the company's general eastern manager. This new department will be in direct communication with the home office, and orders received there will be promptly taken care of.

THE NEW YORK AIR COMPRESSOR COMPANY has recently issued a new catalogue illustrating and describing the latest types of air compressors manufactured by this company. These compressors are designed for the operation of pneumatic tools and machinery in machine shops, boiler shops, etc. The catalogue also contains much valuable information relating to the points to be considered in the purchase of air compressing machinery and its proper installation.

THE GOLD CAR HEATING COMPANY, of New York city, has just won an important patent suit in Canada against the Consolidated Car Heating Company, of Albany. The Court of Appeals at Montreal, Canada, has decided that the Gold Strightport steam hose coupler does not infringe the Sewall patents. The Gold company considers this a pronounced victory over the Consolidated Car Heating Company, and one which is strengthened by the fact that all five judges were of the same opinion, rendering a unanimous decision.

THE NEW YORK CENTRAL & HUDSON RIVER RAILROAD, through its general passenger agent, has issued a very interesting new map of Asia and the Chinese Empire. It is known as No. 28 of the New York Central's "Four-Track Series," and contains a large amount of valuable and interesting information concerning the Chinese Empire. It will be found to be of particular value to manufacturers of this country. A copy of this series will be sent free, postpaid, upon receipt of five cents, by General Passenger Agent Daniels, Grand Central Station, New York city.

FRED M. LOCKE, Victor, N. Y., is manufacturing a special insulator known as "Locke No. 6," for telephone and telegraph line construction. It is made of porcelain instead of glass, usually used in work of this kind, and it is claimed to be stronger and cheaper than glass and better in insulation. The two high-power transmission lines in California of the Standard Electric Company and the Bay County Power Company, which are said to be the longest lines of the kind in the world, are now in successful operation, using the insulators made in the Locke factory. The insulators are said to be the largest and strongest ever made for such a purpose, and of the particular type used this factory has produced a great number during the past year.

THE WARNER ELECTRIC COMPANY, Muncie, Ind., is mailing a new catalogue dealing with its Warner pole-changer and other electrical novelties. The pole-changer is said to be the safest, most reliable and economical ringing device now on the market, and its reception from both Bell and independent telephone companies is stated to have been most satisfactory. The machine has been on the market a little over three years, but in that time over 1,200 have been sold, the company having them in successful operation in nearly every city in the Union, as well as four foreign countries. Descriptive matter and prices will be mailed to any one desiring them.

THE L. WOLFF MANUFACTURING COMPANY, manufacturer of plumbers supplies, recently contracted with the Northern Electrical Manufacturing Company, of Madison, Wis., through its Chicago office, for a complete equipment of generators and motors to be installed in its immense works located at Carroll avenue and Roby street, Chicago. Constant additions to the plant, coupled with the necessity of introducing modern methods to compete with other and younger manufacturers who have equipped their factories with electric motors, were the principal reasons for making the change at this time. The installation will consist of two 200-kilowatt, 250-volt generators, direct-connected to Allis-Corliss engines, operated at a speed of 110 revolutions per minute. The motors will be slow speed, a number of them being entirely enclosed, and arranged, as far as possible, for individual driving of machines throughout the plant; ranging in sizes of from 7½ to 80 horsepower each.

Educational News

THE U. S. GRANT UNIVERSITY at Chattanooga, Tenn., will have a new building for its scientific department, which will be erected at a cost of $23,000.

THE ARMOUR INSTITUTE, Chicago, just received another gift of $250,000 from Mrs. Philip B. Armour and Mr. J. Ogden Armour, in addition to the $1,000,000 recently given to the institute by them. A building for the Memorial School of Engineering will be erected at once.

THE UNIVERSITY OF CHICAGO has received a joint gift from Messrs. Martin A. Ryerson and John D. Rockefeller in the shape of land on Ellis avenue, Chicago, valued at $91,531.16. Now that the University has secured sufficient land for building sites it is pushing plans as rapidly as possible for the new structures, and ground has already been broken for the central light, heat and power plant, which will be erected at a cost of $150,000, and will supply heat, light and power for all of the University buildings and grounds. The buildings will be large enough to provide for all necessities of the future. A battery of 16 boilers will be installed.

THE INTERNATIONAL CORRESPONDENCE SCHOOLS, Scranton, Pa., state that if they had attempted to use text books loaded down with technical terms they never could have succeeded in girdling the earth with students whose work has enabled them to rise from their old positions to take ones of greater responsibility and importance. The system of the schools is stated to be very similar to the method employed by Doctor Tyndall, who used to lecture on light and electricity to audiences of children, holding their fascinated attention without apparent effort. The text-books used by the school have a similarly easy way of putting things which is stated to be their characteristic feature and the keynote of the success which has been attained by them.

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ELECTRICAL REVIEW

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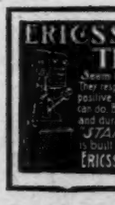
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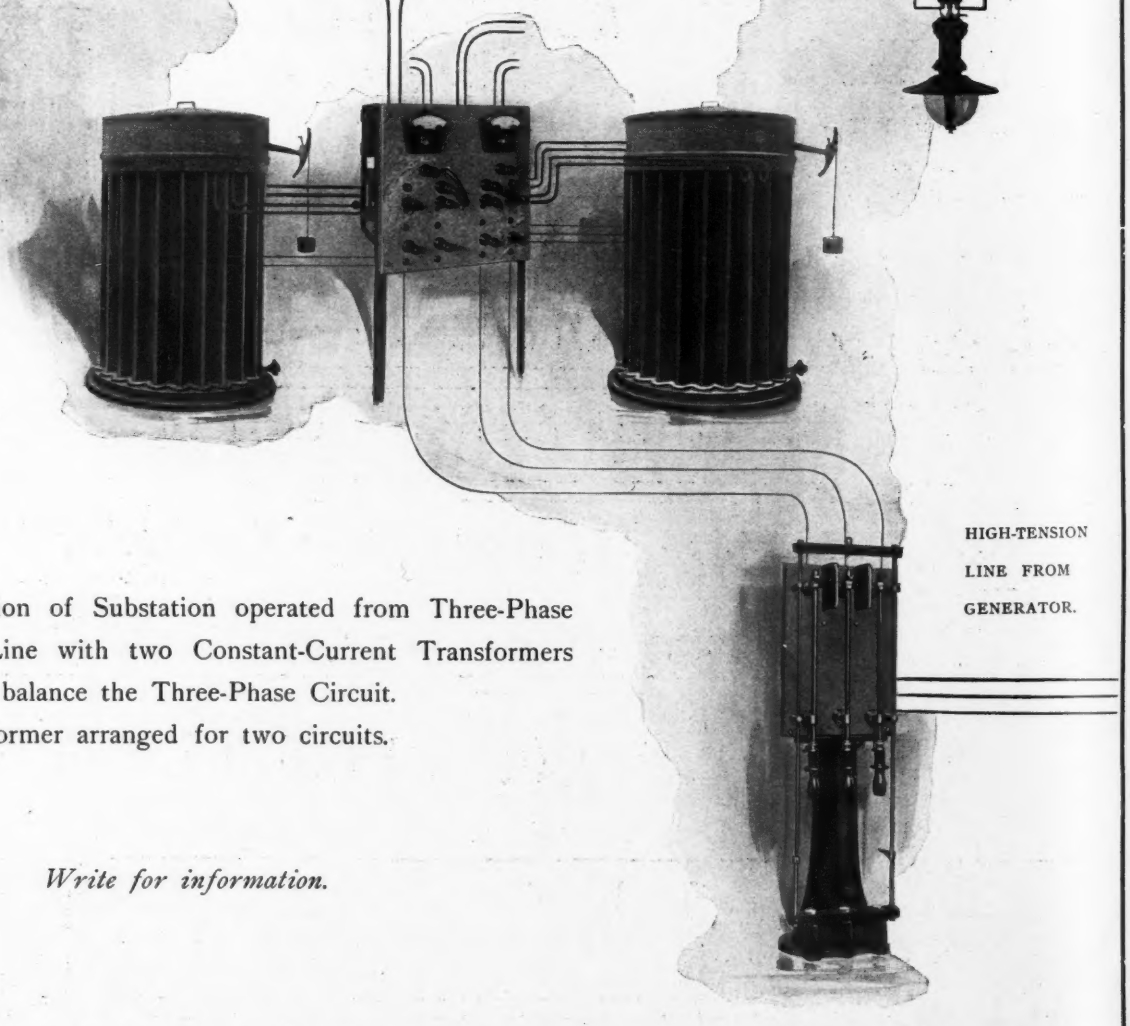

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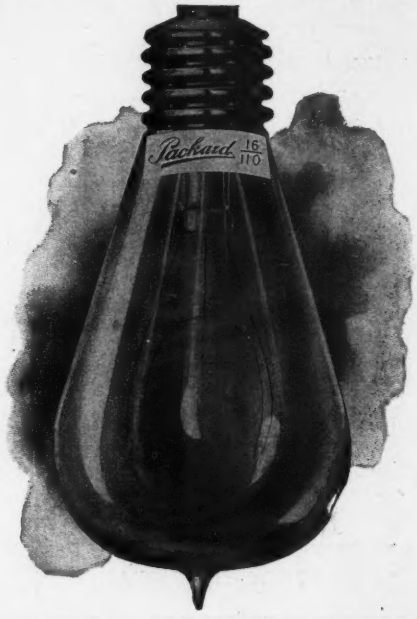

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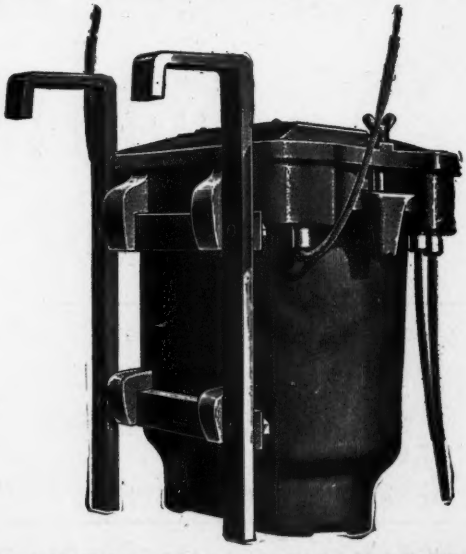

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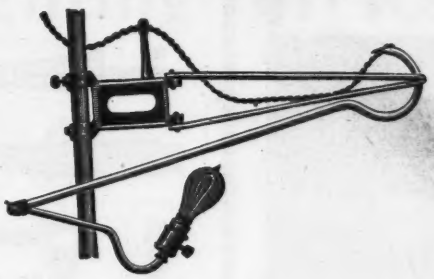

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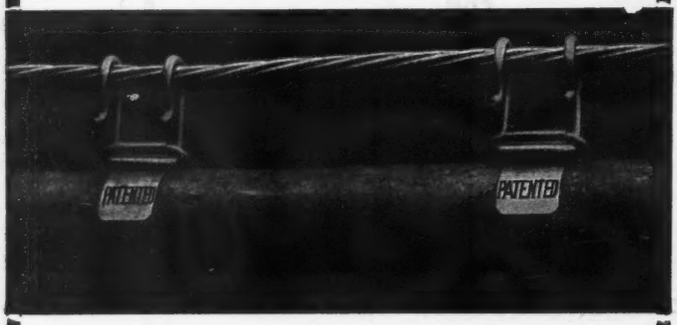

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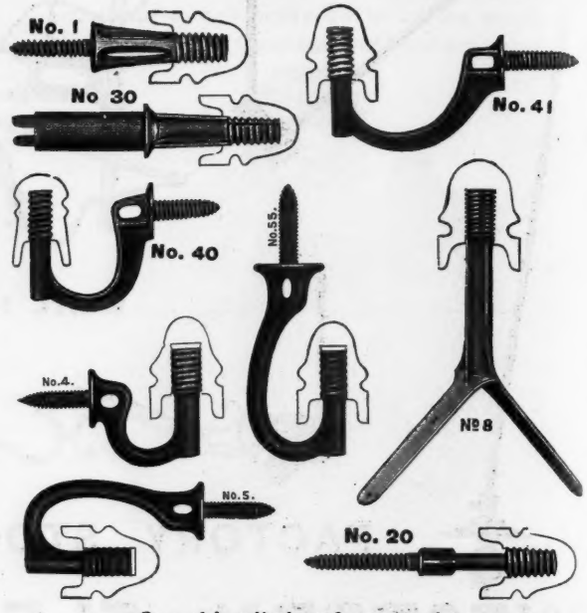

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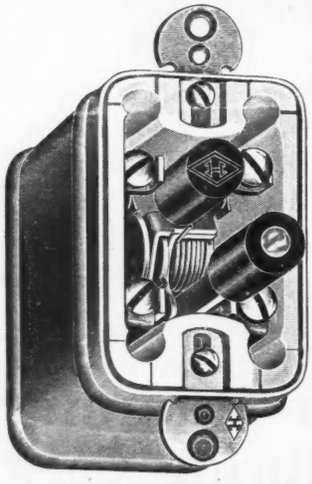

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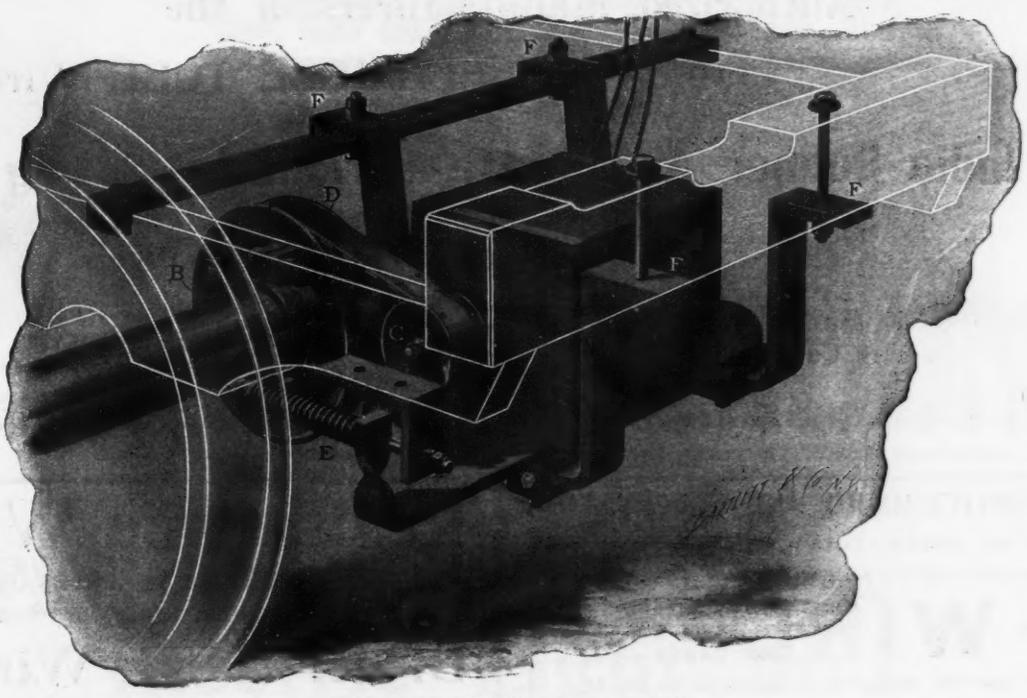

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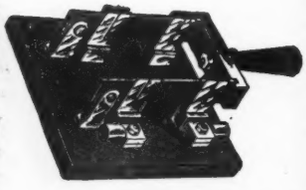

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7/8	15.04	138.12	155.03	223.61	84.55
3/4	15.11	127.67	133.24	191.06	83.68
5/8	15.88	131.50	112.65	162.80	80.25
1/2	16.47	126.87	90.04	127.73	75.96

Test of a 35 in. Samson Feb. 1 '97

Gate Open	Head	Rev. Pr. Min.	Cu. Ft. Pr. Sec.	Horse Power	Per Cent
Full	15.29	194.25	102.02	143.44	81.08
7/8	16.56	187.75	92 15	146.73	84.78
3/4	17.33	178.50	83.95	138.40	83 86
5/8	17.54	176.40	68.82	109.64	80.09
1/2	17.68	168.50	57.69	88.14	76.19

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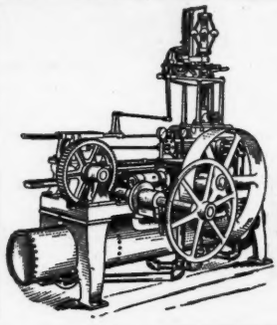

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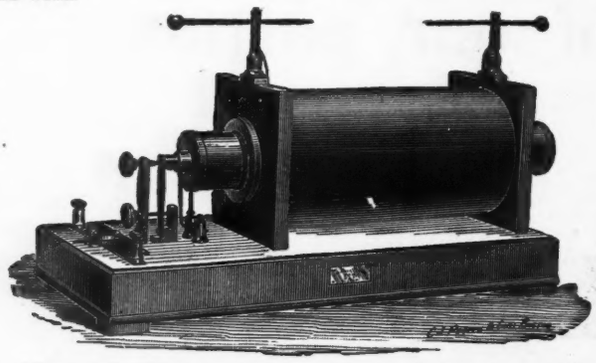

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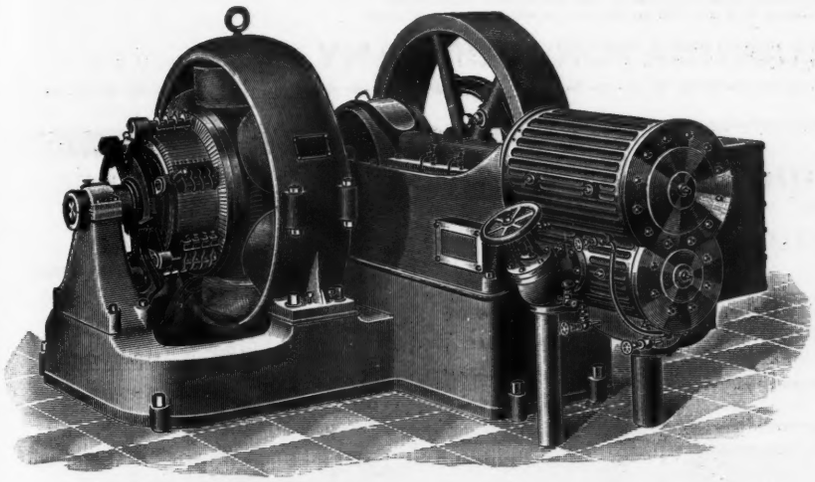

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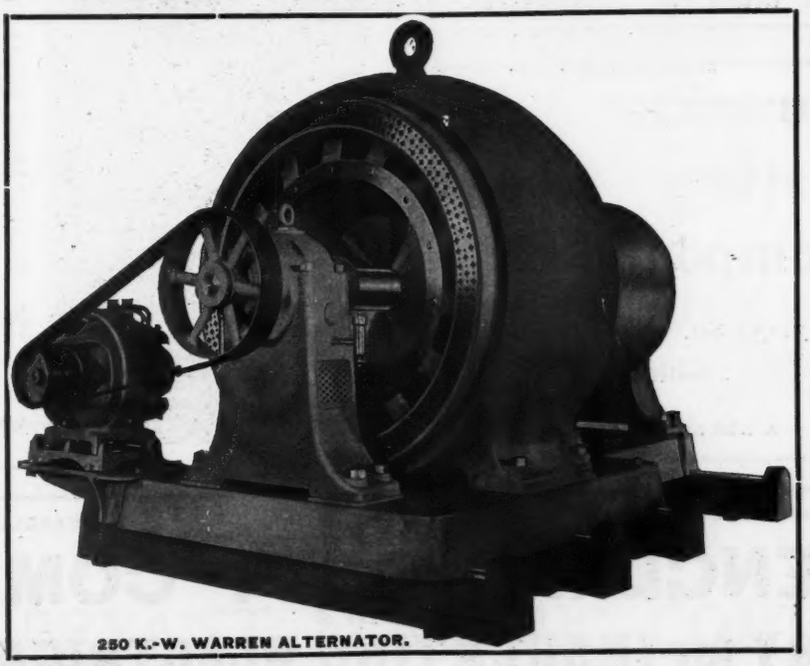

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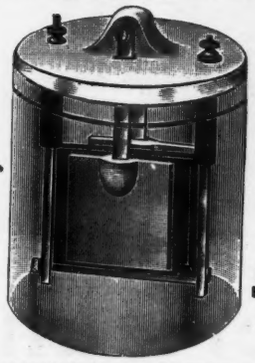

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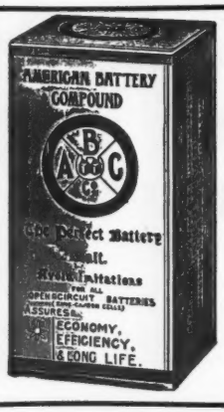

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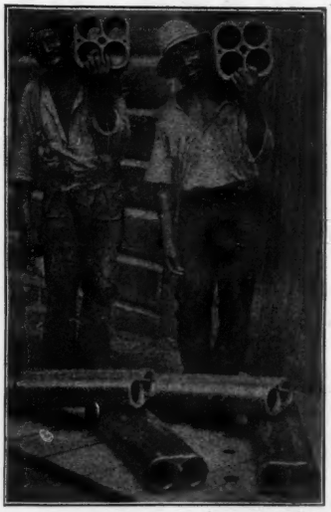

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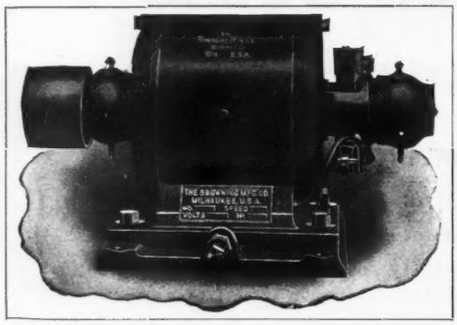

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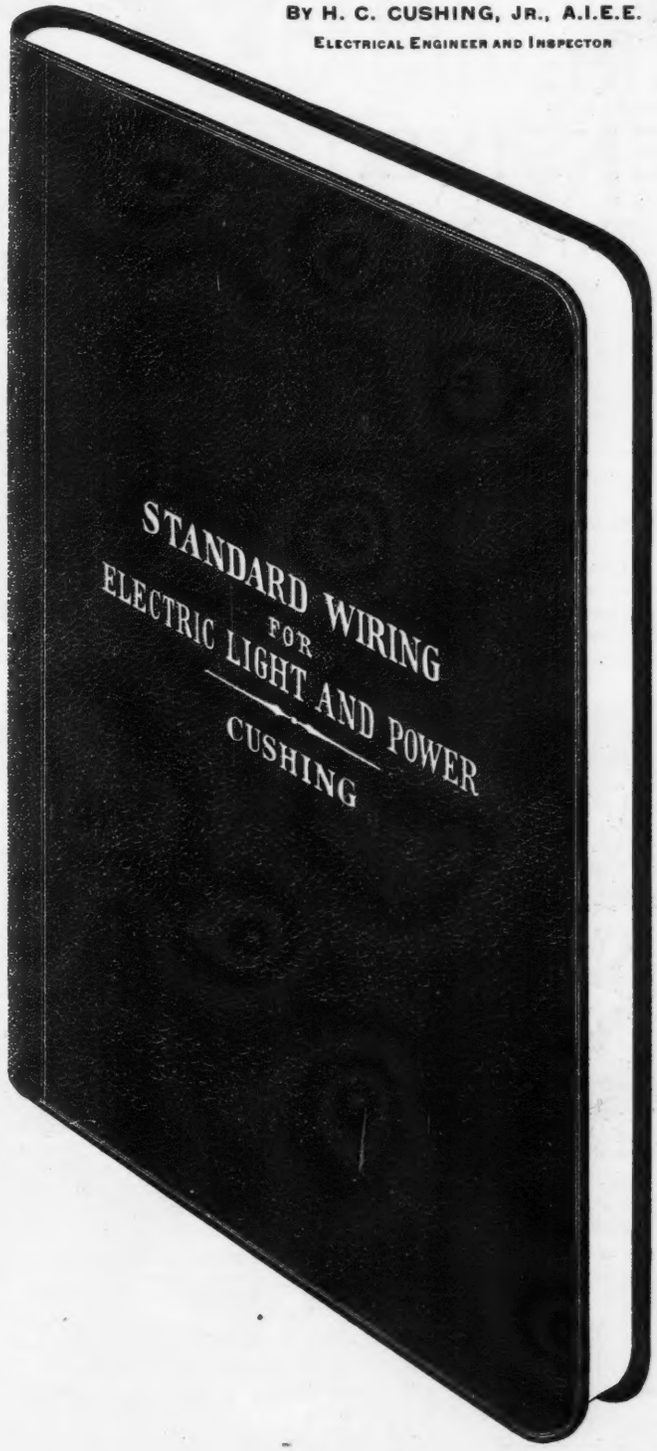

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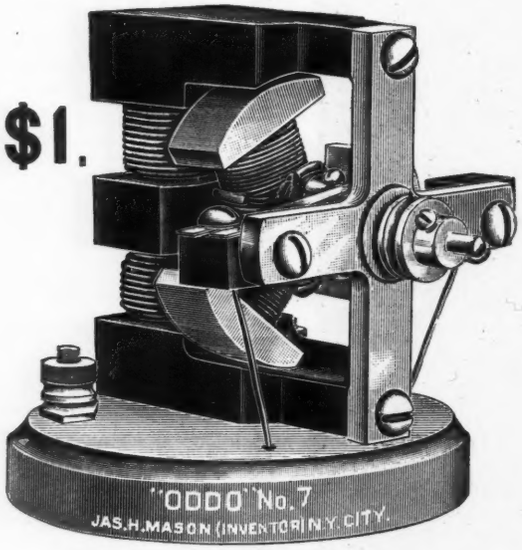

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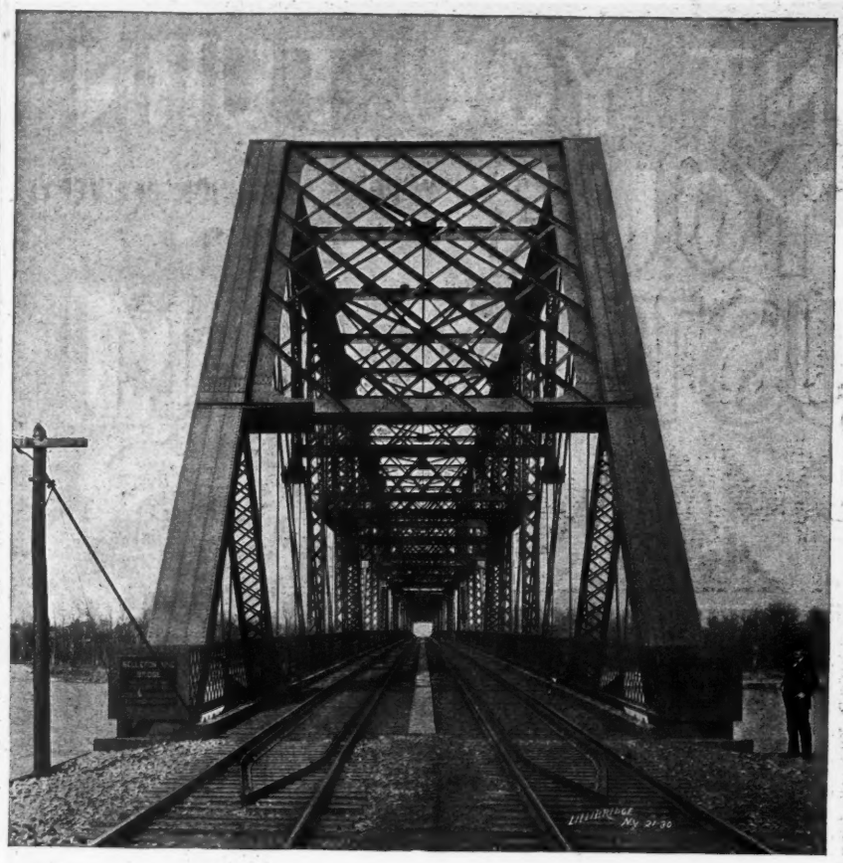

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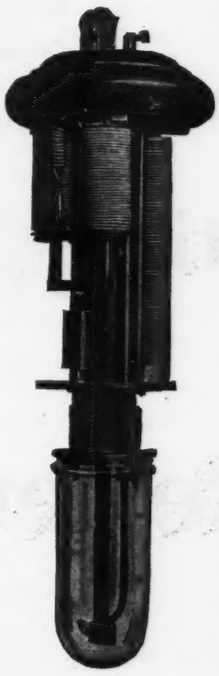

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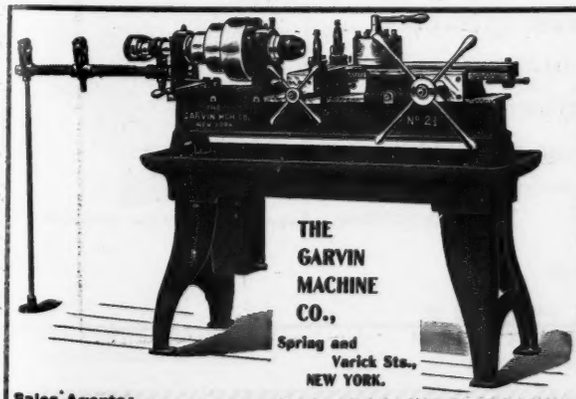

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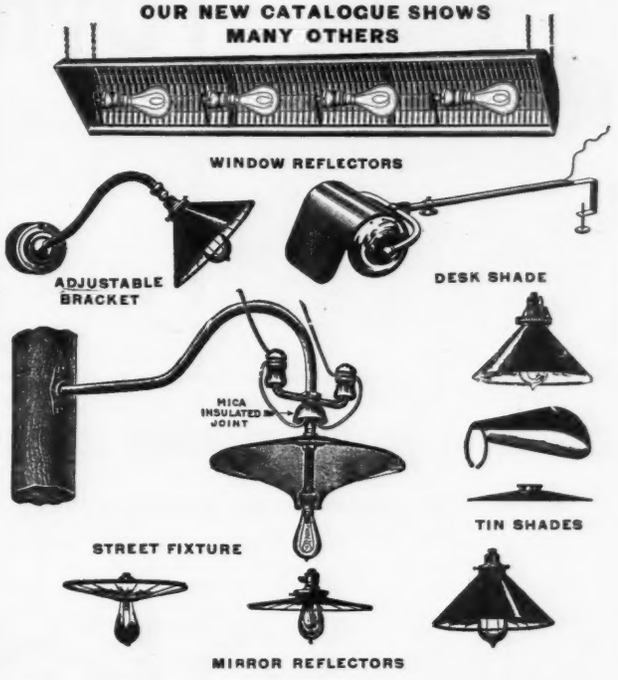

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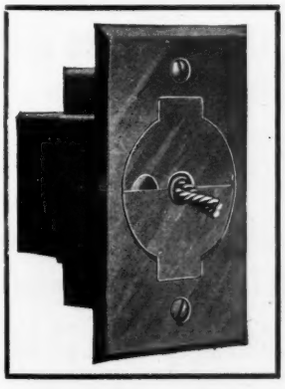

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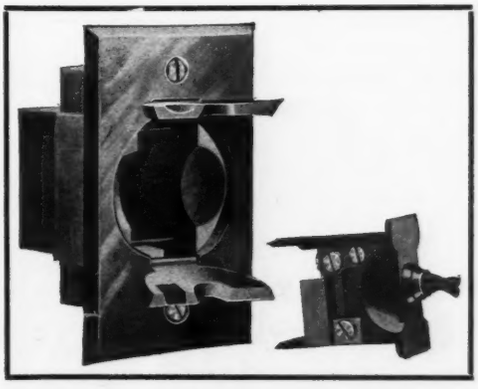

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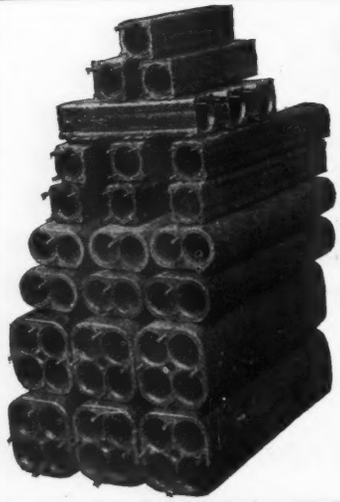

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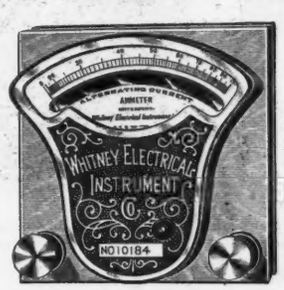

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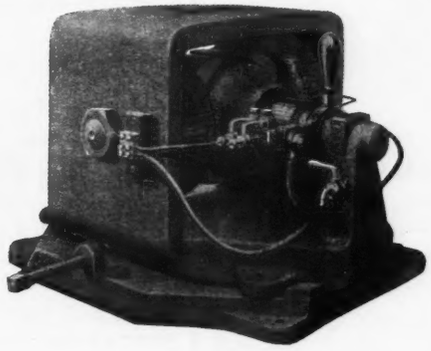

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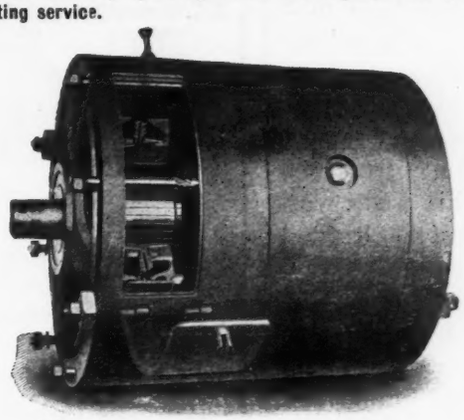

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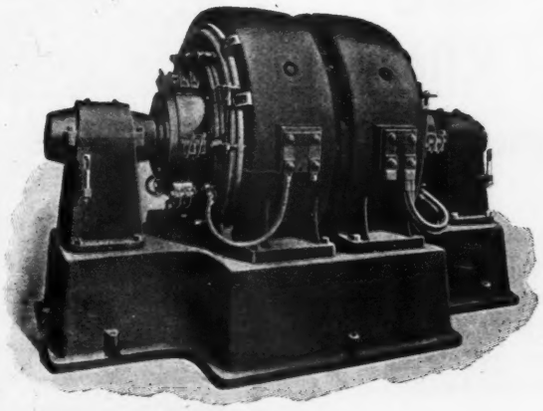

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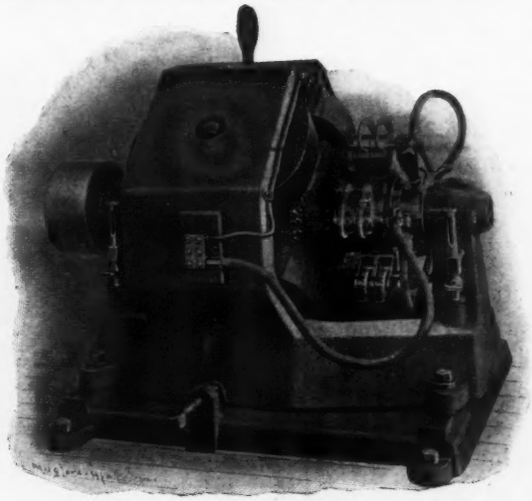

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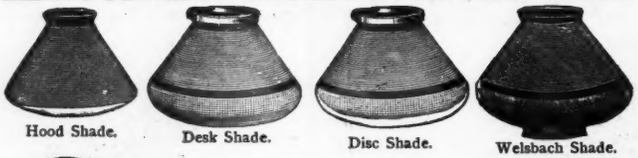

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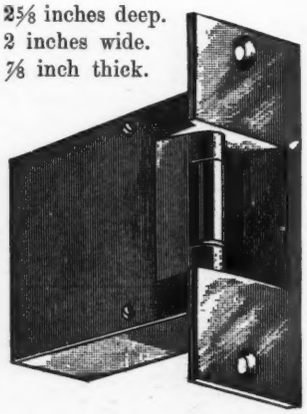

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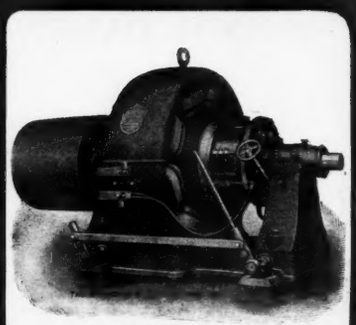
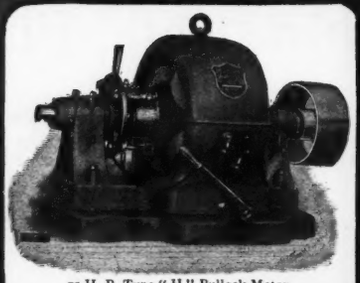


200 K. W. Type "H" Bullock Generator.

DYNAMOS AND MOTORS

FOR EVERY SERVICE

SEND FOR DESCRIPTIVE BULLETINS



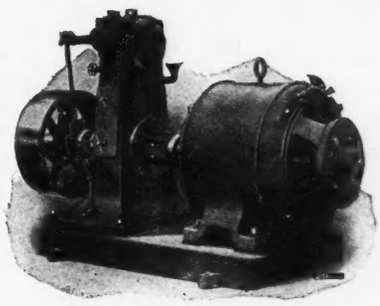
75 H. P. Type "H" Bullock Motor.

25 H. P. Type "N" Bullock Motor.

BULLOCK ELECTRIC MFG. CO.

CINCINNATI, OHIO, U.S.A.

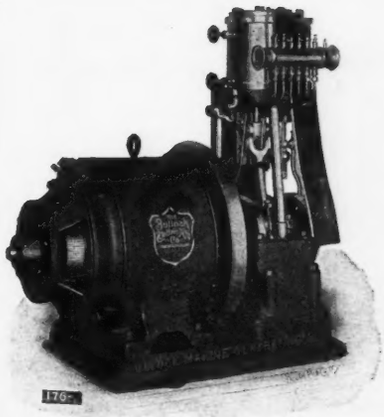
BULLOCK



4 1-2 K. W. Type "N-I" Bullock Generator and Gas Engine.

Marine Lighting and Power Sets

SEND FOR BULLETIN No. 36



7 K. W. Type "N-I" Bullock Generator and Forbes Engine.
(Cast Iron Sub-base.)

BULLOCK ELECTRIC MFG. CO.

CINCINNATI, OHIO, U.S.A.

225

Bullock Dynamos and Motors for Immediate Delivery

GENERATORS

No.	Type.	K.-W. 120 Volts.	Speed.
3	H	6	1000
10	H	9	1600*
1	H	9	1350
6	H	9	900
1	E	9	525
3	H	12	800
5	H	12.5	1350
6	H	16	1250
5	H	16	725
2	H	22	675
8	H	22.5	1050
4	H	30	1000
2	H	30	650
	H	42.5	900
2	H	42.5	600
3	H	55	550
3	H	60	875
4	H	75	830
1	H	75	500
1	H	85	625
2	NI	9	360
5	I	15	360
12	I	25	350
3	I	30	300
2	I	30	360
2	I	30	350
1	I	40	350
2	I	50	300
6	I	50	275
3	I	60	275
2	I	75	275
2	I	75	260*
1	I	100	250
1	I	100	275*
		240 Volts.	
1	H	12	900
3	H	16	1250
1	H	16	725
5	H	22	675
2	H	30	1000
1	H	30	650
4	H	42.5	900
1	H	42.5	600
3	H	55	550
3	H	60	875
3	H	75	830
1	H	75	500
1	H	85	625
2	NI	9	360
5	I	15	360
12	I	25	350
1	H	4	500
4	H	100	650
1	H	150	475*
3	I	25	350*
2	I	30	350
1	I	50	300
3	I	50	275
2	I	100	250
3	I	100	275
1	I	150	225
		500 Volts.	
4	H	30	1000
3	H	30	650
1	H	42.5	900
1	H	42.5	600
3	H	55	550
1	H	60	875
2	H	75	830
2	H	75	500
2	H	100	650

MOTORS

No.	Type.	H.-P. 120 Volts.	Speed.
1	E	2	2300
1	H	7	775
3	H	7	950
10	H	10	1500*
1	N-108	10	950
4	H	10	850
1	H	15	1350
7	H	15	1300
4	H	15	750
1	H	15	725
1	H	15	550
6	H	20	1200
2	H	20	850
1	H	20	800
2	H	20	550
4	H	20	700
9	H	25	1000
2	H	25	625
1	H	25	900
1	H	35	575
1	H	35	1000
4	H	35	950
1	H	35	750
2	H	35	600
2	H	50	850
1	H	50	550
2	H	65	520
2	H	75	825
3	H	90	795
		240 Volts.	
3	H	7	900
1	H	7	950
4	H	10	1500
1	H	15	1450
2	H	15	1400
3	H	15	1300
2	H	20	1200
1	H	20	675
1	H	25	650
1	E	20	250
5	H	25	625
2	H	35	950
1	H	35	600
4	H	50	850
1	H	50	550
1	H	60	750
3	H	65	520
2	H	75	825
3	H	90	795
1	H	90	475
2	H	125	625
1	H	185	450*
		500 Volts.	
2	H	5	900
2	H	7	950
1	H	7	925
1	H	7	875
1	H	7.5	1500
4	H	10	1500
1	H	10	1450
1	H	10	900
2	H	10	850
5	H	15	1300
1	H	15	1350
2	H	15	750
1	H	15	700
1	H	15	725
1	H	20	1200
1	H	20	950
1	H	20	650
1	H	20	700
4	H	25	1000
1	H	25	600
2	H	25	625
4	H	35	950
3	H	35	600
1	H	50	850
1	H	50	550
3	H	65	520
1	H	75	825
2	H	90	795
2	H	90	475
2	H	125	625

TYPE "N" ENCLOSED MOTORS†

No.	Type.	No. Yoke.
51	N-64	1
42	N-66	2
25	N-104	3
18	N-106	4
3	N-106	5
19	N-108	5
12	N-108	6
16	N-136	7
10	N-136	8
15	N-139	8
17	N-139	9
5	N-168	10
6	N-1612	12

† For ratings at various speeds of our type "N" machines, see our Bulletin No. 35a.

* Machines marked thus can be delivered in 30 days. Immediate delivery can be made on all other machines.

Bullock Electric Mfg. Company

CINCINNATI, OHIO, U. S. A.

239

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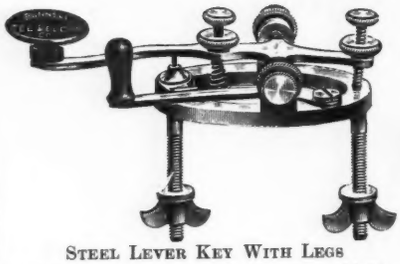

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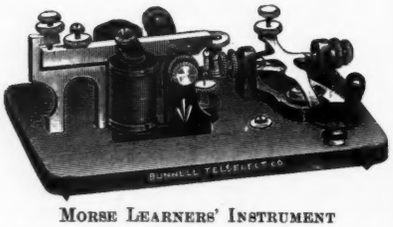

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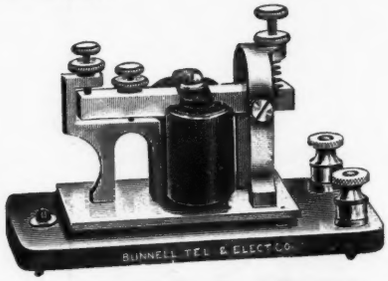

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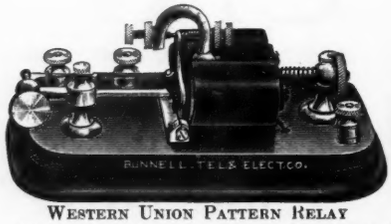
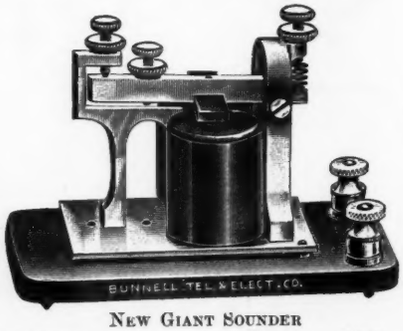
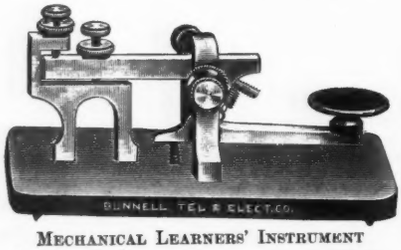
Price $4.00



WESTERN UNION PATTERN RELAY
Price $2.30



NEW GIANT SOUNDER
Price $2.75



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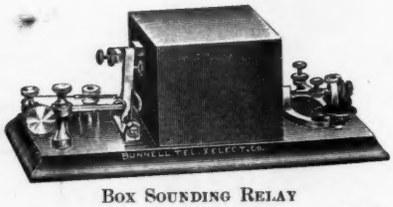

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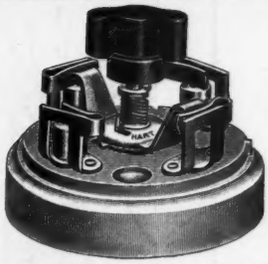
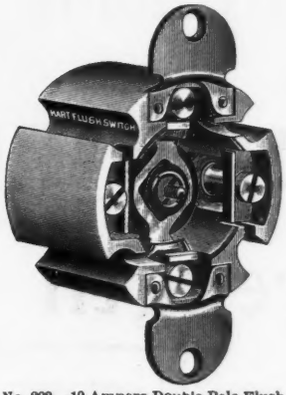
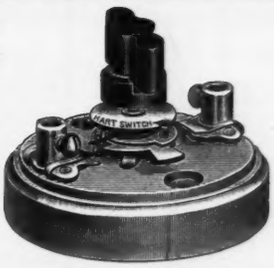


No. 23½.—1-Ampere 3-way. For 500-Volt Circuits.



No. 202.—10-Ampere Double-Pole Flush With Plate Removed.



No. 20.—5-Ampere Single Pole.

No. 702.—10-Ampere Double-Pole Push Button Without Face-Plate.

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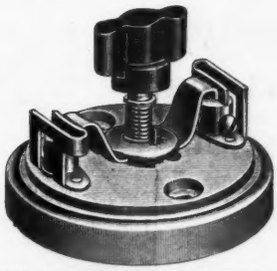
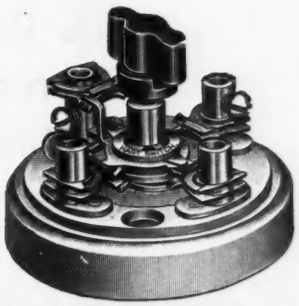


No. 20½.—3-Ampere Single Pole. For 500-Volt Circuits.

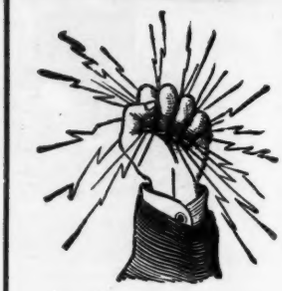
Flush Switch Complete.



No. 29.—Electrolier.

Nos. 22, 32 and 42.—10-Ampere Double Pole, 20-Ampere Double Pole. 35-Ampere Double Pole.

WIRE



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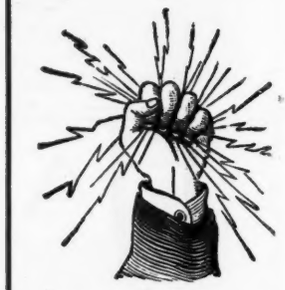

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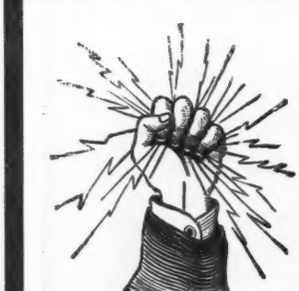

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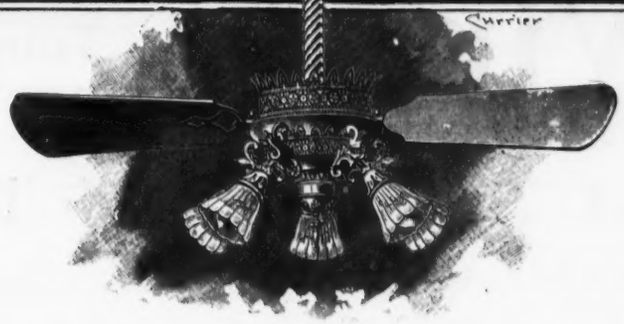

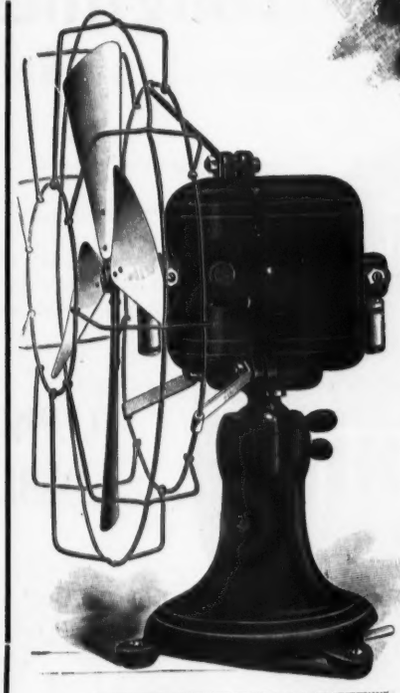

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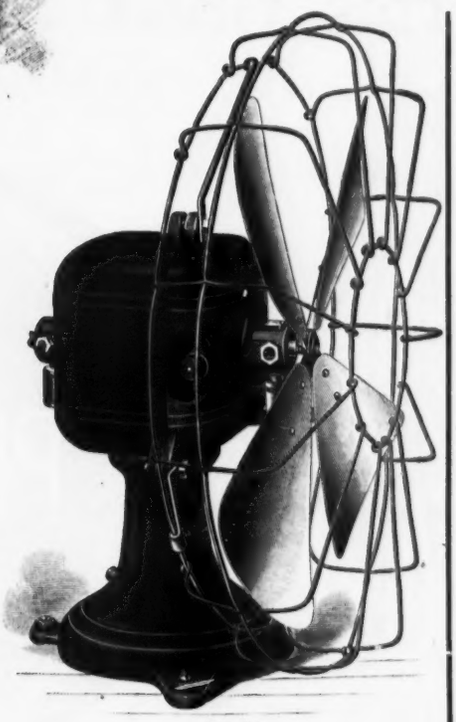

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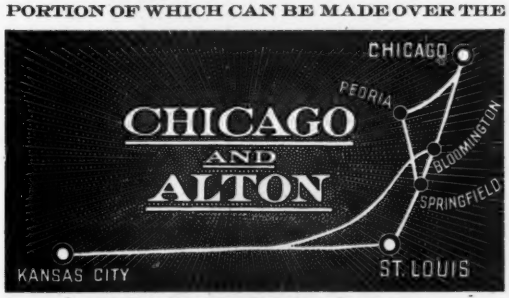

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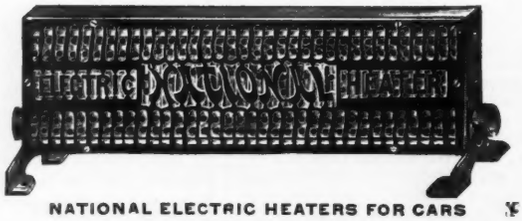

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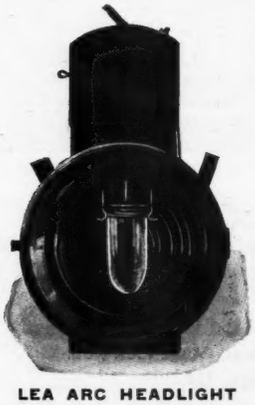

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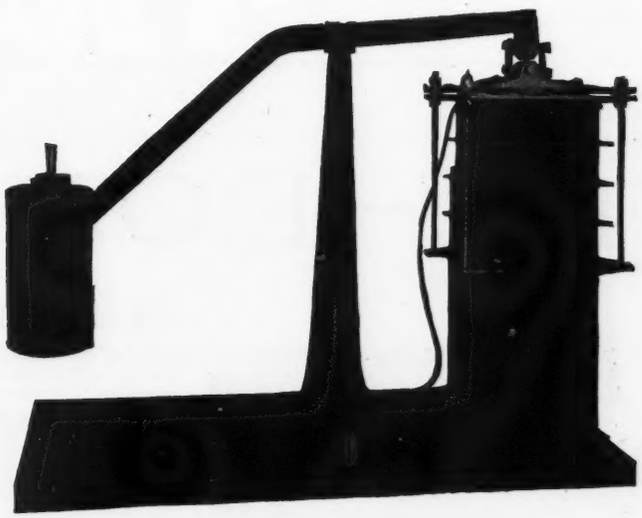

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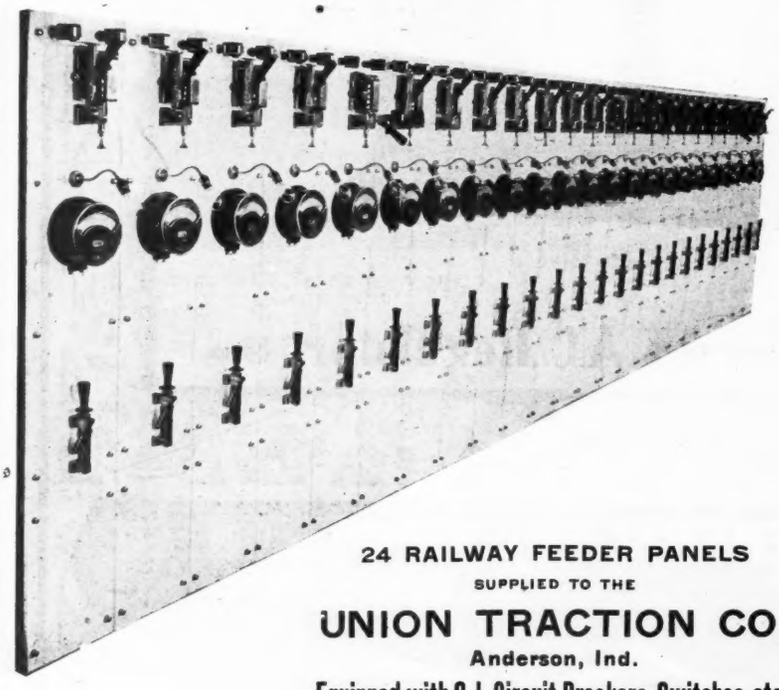

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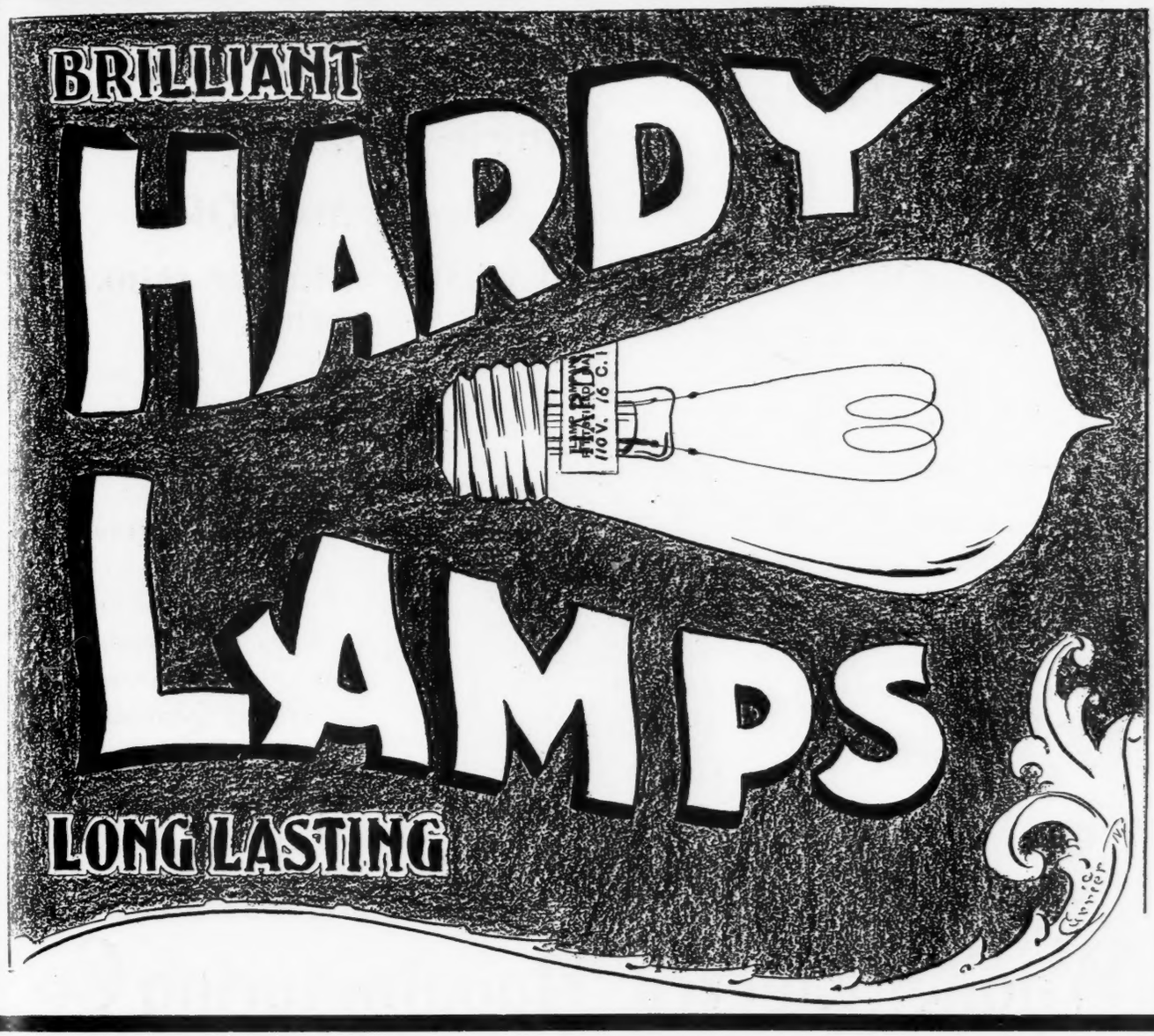

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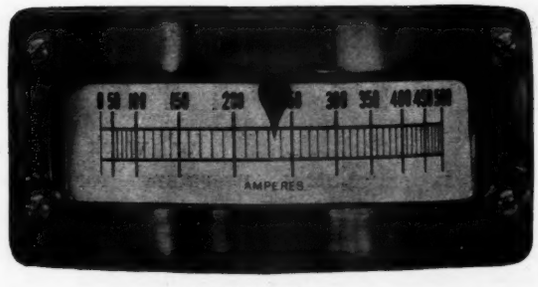

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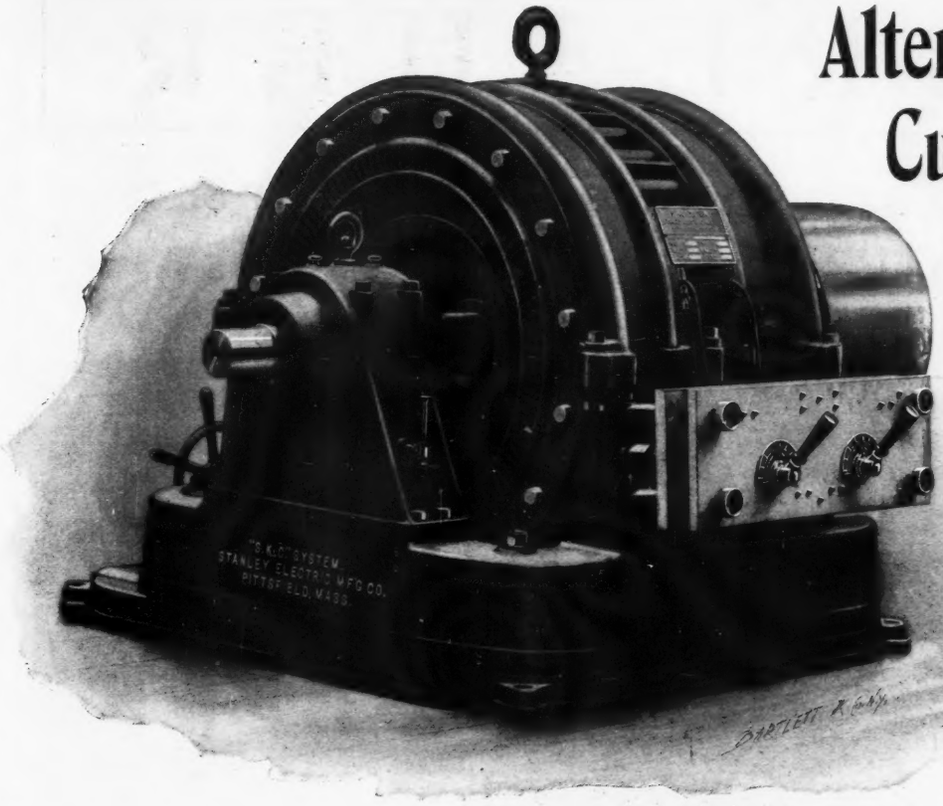

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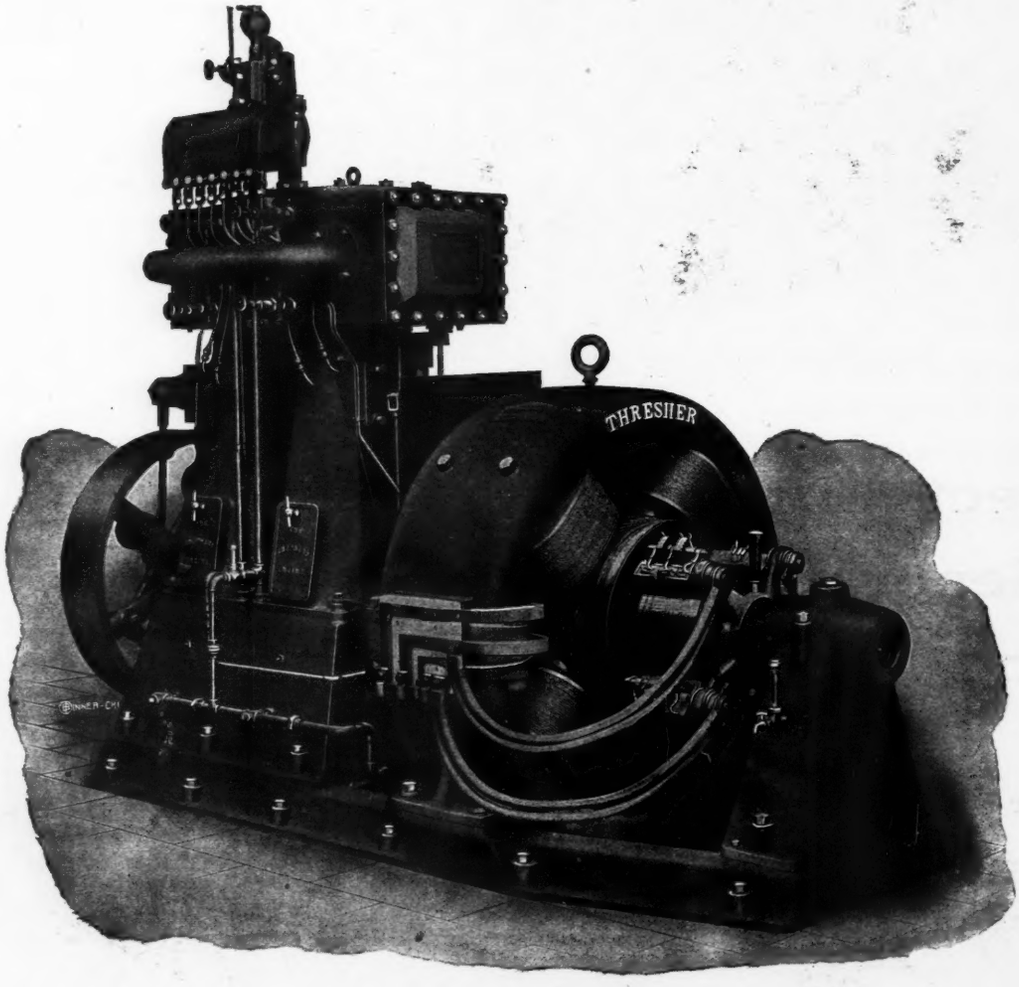

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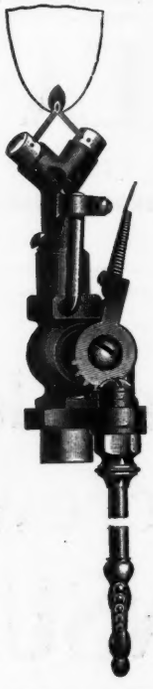

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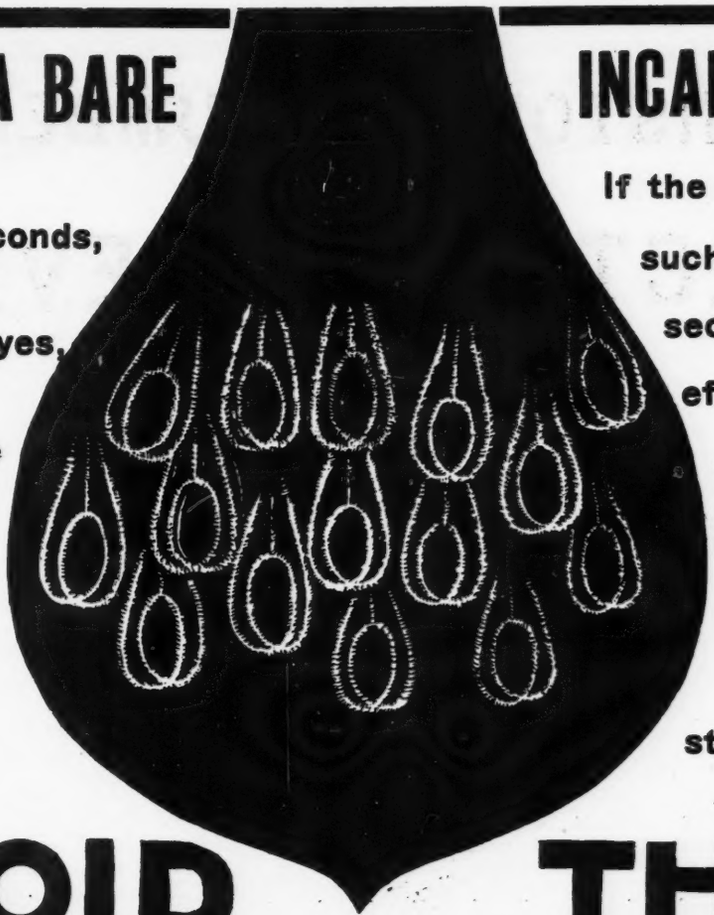
lamp for ten seconds, then shut your eyes, and you will see what is meant by the above illustration.



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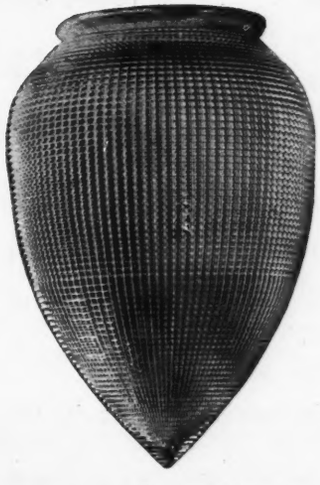

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New York, January 12, 1901

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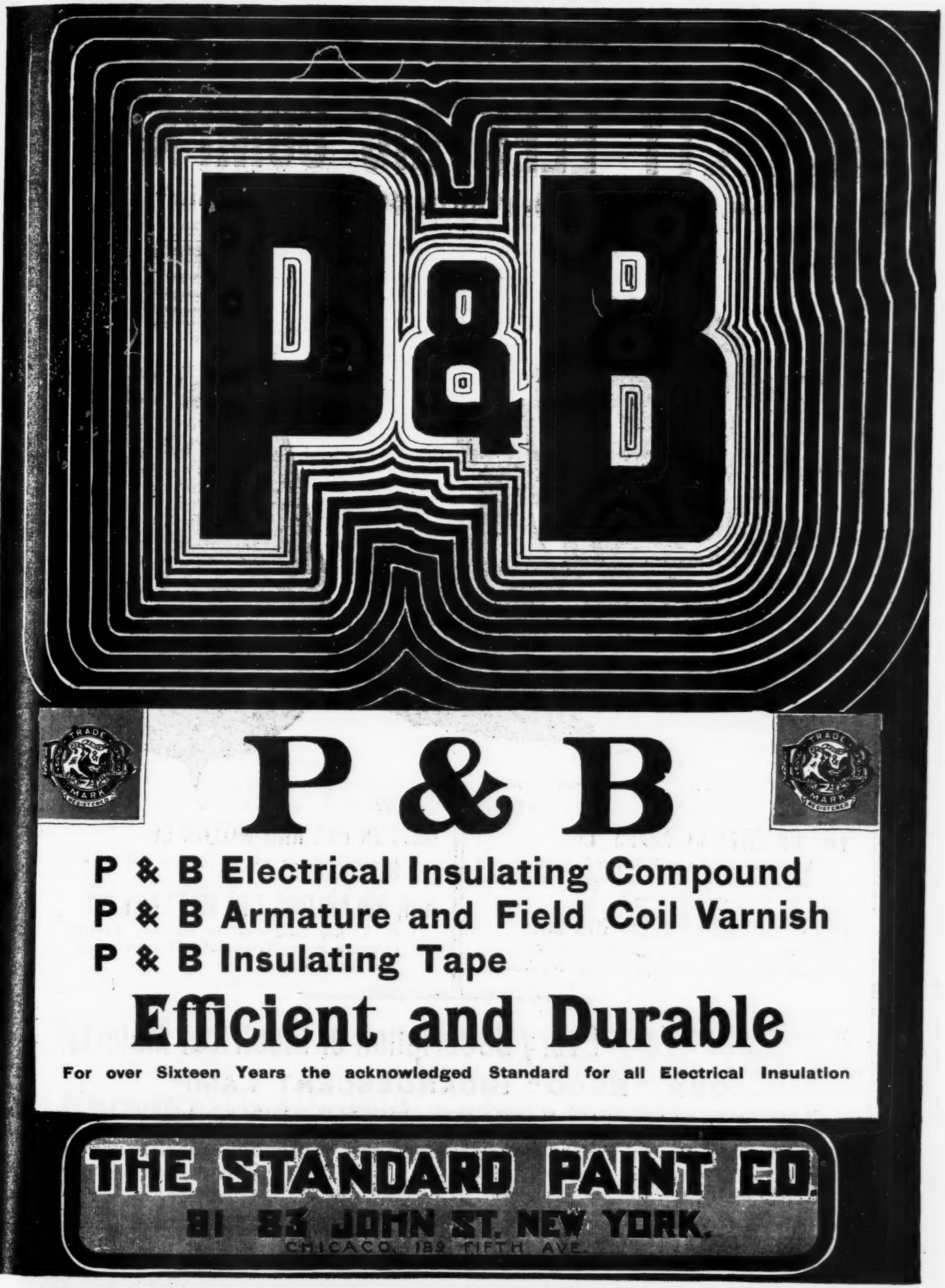
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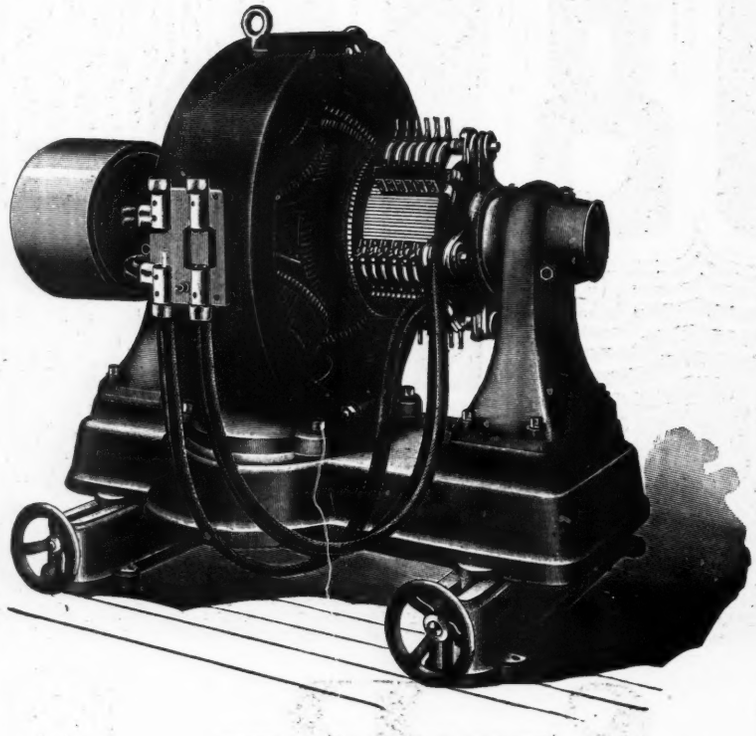

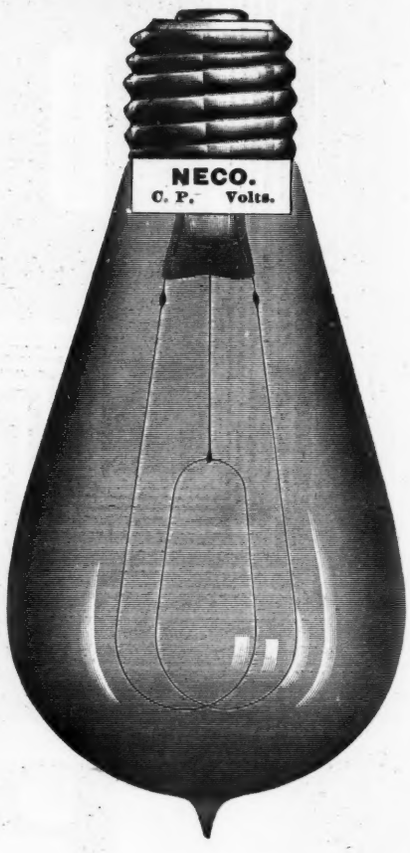

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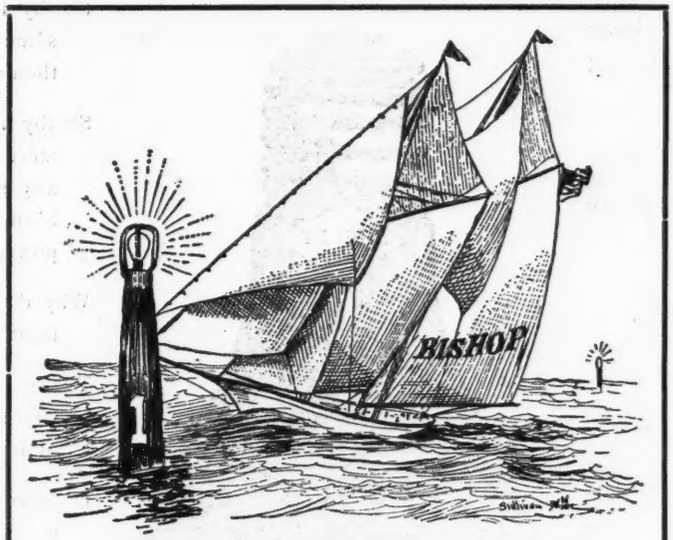

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The USEFUL LIGHT is that passing through the end of the lamp.

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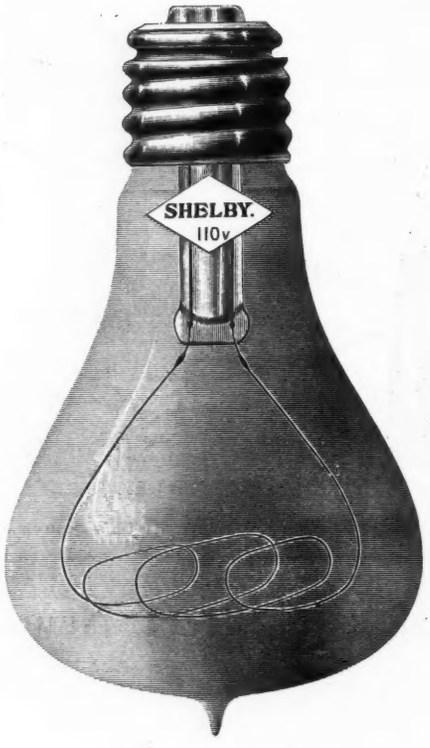
You want the most light for current consumed.



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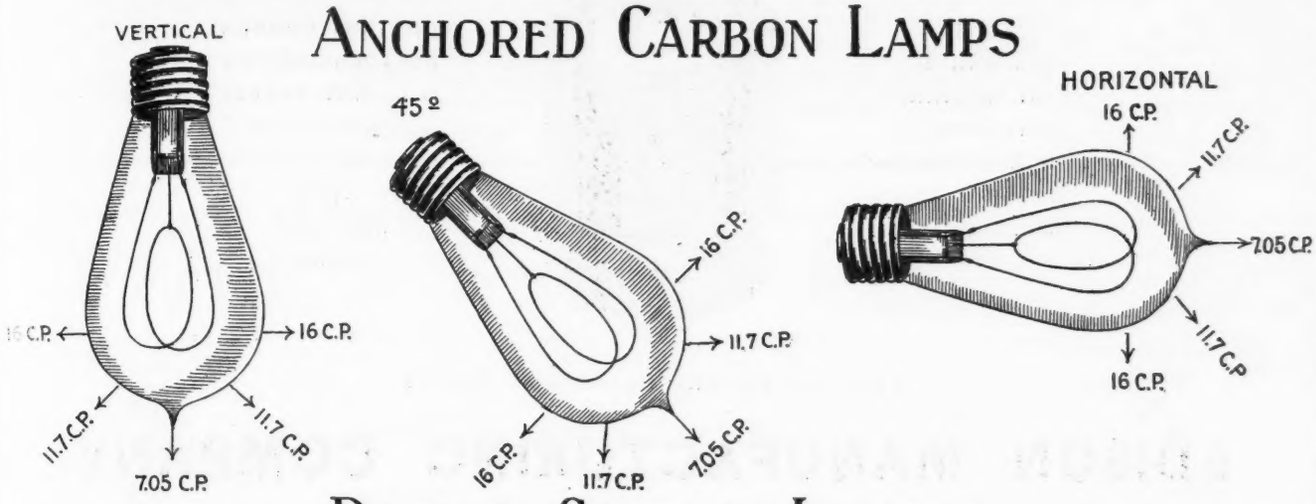
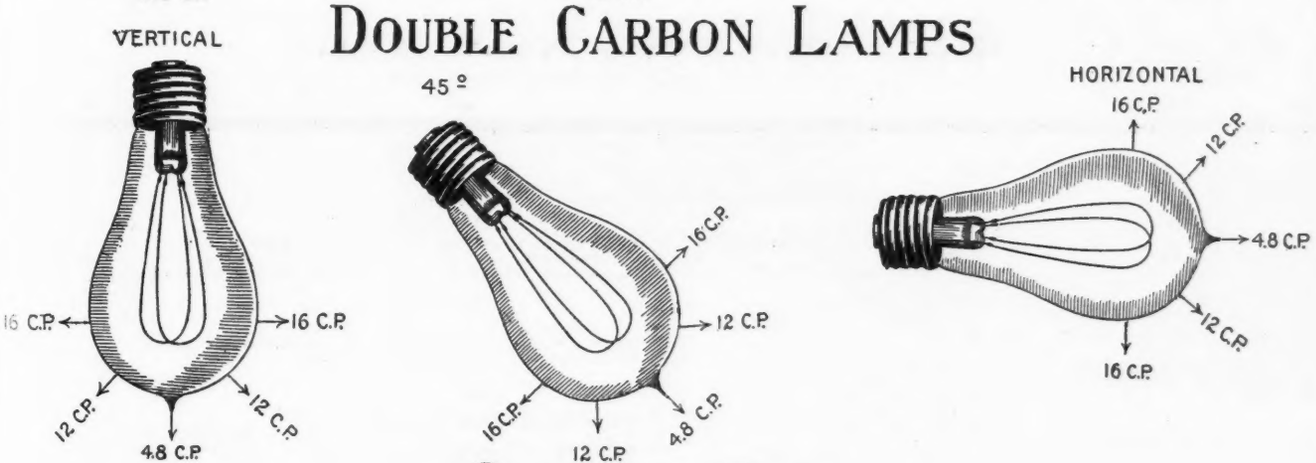


DOUBLE CARBON LAMPS



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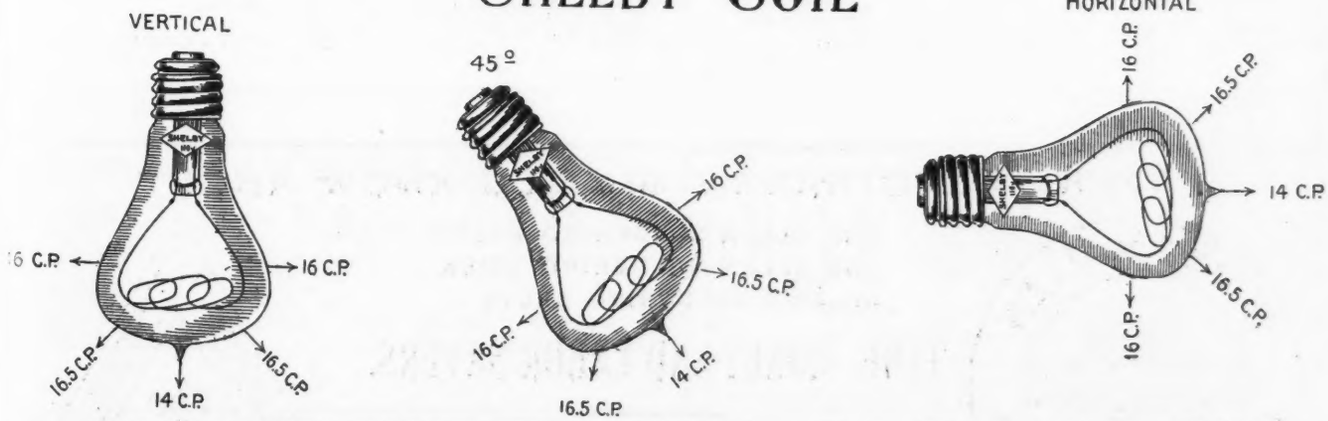

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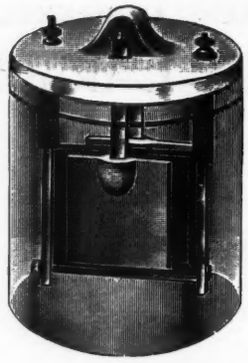

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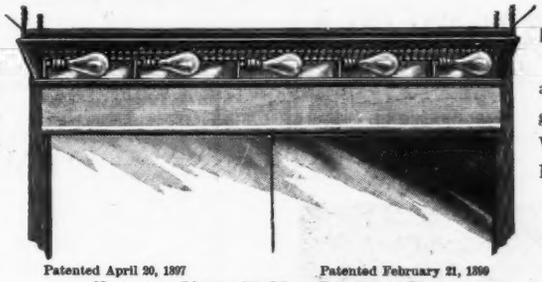

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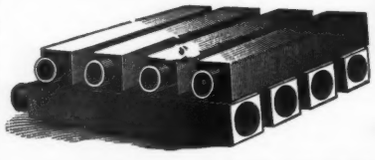

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Electrical Patents

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED DECEMBER 25, 1900.

664,369 Telegraphy; W. E. Athearn, New York, N. Y.—A telegraph line, a pair of condensers, a source of electrical energy for charging said condensers, and Morse signal-transmitters for alternately discharging said condensers into the line.

644,371 Electric heater and circuit-controller therefor; J. I. Ayer, Malden, Mass.

664,396 Dynamo-electric machine; I. Fisher, Boston, Mass.

664,430 Telautograph or fac simile telegraph; A. Pollak, Buda-Pesth, Austria.

664,432 Insulator; E. Renault, Waldo, Fla.

664,440 Coil for electromagnets; S. D. Sprong, Long Branch, N. J.—Comprises a central tubular cylinder of insulating material, coils of wire of differing thickness surrounding said cylinder and separating and insulating said coils, and pierced with apertures through which pass the inner ends of said wires, and all the said parts detachably connected.

664,459 Overhead electric trolley; J. H. Brown, Pittsfield, Mass.

664,503 Collector ring; H. G. Reist, Schenectady, N. Y.—A current collector composed of contact rings provided at a plurality of points on the inner wall with insulating material, and metal centering-pieces clamped around the insulating material to afford a seat on the support.

664,511 Electric cutout; J. H. Trumbull, Hartford, Ct.

664,550 Electrolytic treatment of iron for preservation thereof; H. H. Hollis, Chicago, Ill.

664,554 Regulating socket for multifilament incandescent electric lamps; C. A. Hussey, New York, N. Y.

664,557 Telegraph switchboard; F. W. Jones, New York, N. Y.

664,579 Switch for railways; F. S. Pearson, Boston, Mass.

664,594 Means for transmitting motion to distant points; D. P. Thomson, Lynn, Mass.—A device to be controlled comprising relatively movable members provided with suitable windings, an alternating-current source connected to the winding on one of said members, and means for short-circuiting the winding on one of said members, and means for short-circuiting the winding on the other member along a predetermined line or lines.

664,649 Brush holder for dynamo-electric machines; C. W. Kragh, Madison, Wis.—Comprises a holding-piece provided with an opening in which the brush is movably received, a contact-piece adapted to make stationary contact with the brush and with the holding-piece, said contact-piece formed to removably receive a portion of the brush, and means for elastically forcing said brush against the commutator.

664,650 Electromagnetic ore-separator; E. Kreuser, Mechernich, Germany.

664,667 Electric push-button; T. A. Nathans, New York, N. Y.

664,668 Automatic thermostatic valve; J. E. Noble, Fort Wayne, Ind.

664,679 Accumulator; L. Renaud, Paris, France.

664,681 Electric call box; E. E. Salisbury, Chicago, Ill.—A spring-

(Continued on page 68.)

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MECHANICAL and ELECTRICAL ENGINEERS.
Plans and specifications for and superintendence of Electric Power and Lighting Plants a specialty.
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GUARANTEED TO GIVE "MAXIMUM LIGHT, COMPLETE DIFFUSION, MINIMUM GLARE," for directing and diffusing ALL KINDS OF LIGHT.....
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Jas. L. Robertson & Sons, 229 Fulton Street, New York.

PATENTS.

(*Continued from page 67.*)

actuated circuit-closer, consisting of radial arms in the electric circuit, a circuit-breaker coacting with said arms, an actuating lever adapted to wind the spring, and a retaining device for the circuit-closer adapted to be moved out of its retaining position by a movement of said lever.

664,691 Telephone-exchange system; C. Timberlake, Indianapolis, Ind.—Suitable calling lines and a series of connecting circuits, a switching relay in each connecting circuit so that if the connecting circuit be in use the relay connects a calling line with the switching relay of the next connecting circuit in the series.

664,698 Distributing apparatus for matrix or die-setting machines; Ernst Wentscher, Berlin, Germany.

664,713 Electric arc lamp; R. E. Ball, New York, N. Y.

664,733 Method of converting the energy of alternating electric currents into effective mechanical energy; R. Eickemeyer, Yonkers, N. Y.—The method of reducing counter electromotive force of self-induction in alternating-current machines, by employing air-space resistance in those armature magnetic circuits at which self-induction would otherwise have been developed.

664,757 Telephone-service apparatus; U. S. Jackson, Ossipee, N. H.

664,761 Printing telegraph; E. Kinsman, Malaga, N. J.

664,807 Electric advertising device; P. Dawson, Detroit, Mich.

664,812 Railway æro-electric brake; O. Luyers, Brussels, Belgium.

664,819 Electric safety appliance for railroads; E. L. Orcutt, Somerville, Mass.

ISSUED JANUARY 1, 1901.

664,865 Burglar alarm; J. H. Howard, Kansas City, Mo.—A circuit-closer comprising two longitudinally arranged conducting strips, parallel resilient contact plates held there-between, and an insulating strip between the central portion of said plates.

664,868 Electrically operated cut-off valve for engines; L. Johnson, Milwaukee, Wis.—A mechanically operated inlet valve, a cut-off valve, a source of electric supply, electromagnets which when excited are adapted to close said cut-off valve, and means for controlling the action of said electromagnets.

664,869 Electric wave telegraph; W. S. Johnson, Milwaukee, Wis.

664,886 Ship-bell clock; G. D. McMillan, New York, N. Y.

664,904 Microphone; A. H. Skold, Stockholm, Sweden—A microphone having a single diaphragm and a plurality of contacts at one face of said diaphragm, said contacts being of granulated carbon and in series with the diaphragm and line.

664,907 Electric elevator controller; B. S. Stephens, New York, N. Y.—An electric switch, two independent handropes, one for closing and one for opening said switch.

664,915 Electrical device for determining the resistance or conductivity of bodies; H. E. Warren, Newton, Mass.

664,941 Telephone attachment; G. W. Ganoe, Philipsburg, Pa.

664,948 Electric meter; C. D. Haskins, Newton, Mass.—Comprises two registers, a meter-motor responsive to the current to be measured, provided with a movable armature to gear with either register, and means for shifting the armature into gear with either register.

664,953 Electrical resistance board; W. R. King, Newark, N. J.

(*Continued on page 70.*)

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COMPETENT ARMATURE WINDER
Apply E. A. STARKS, West Point Foundry
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A STORAGE BATTERY of 25 glass jars in perfect condition; 300 ampere-hours. Will sell at half-price. Address
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Flat, Spiral, Volute
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The Standard of the World for the past eight years.
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We sell more Field Rheostats in a month than any other maker of Field Rheostats sells in a year.
Investigate our recent improvements.
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Since 1845 the

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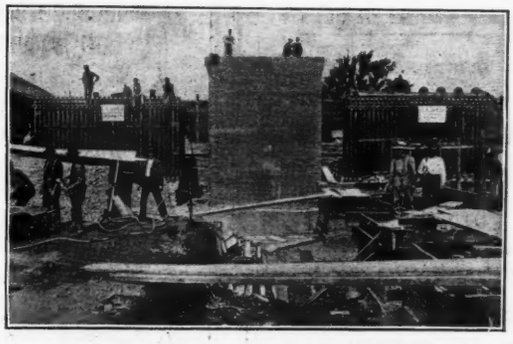

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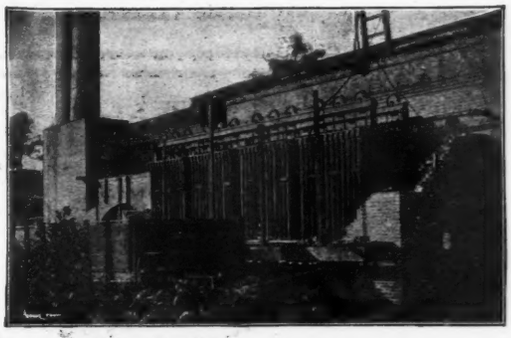

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THE GREEN FUEL ECONOMIZER COMPANY

Matteawan, N. Y.

SOLE MANUFACTURERS IN THE U. S. A.

PATENTS.

(Concluded from page 68.)

664,966 Electrothermostatic cab; for fire alarms; A. Munker, Schoeneberg, Germany.

664,969 Electric motor for railways; E. D. Priest, Schenectady, N. Y.

664,971 Incandescent lamp; E. Riordan, New York, N. Y.

664,986 Electric switch; G. H. Whittingham. Baltimore, Md. — A movable switch element, a reciprocating rod adapted to engage and move the switch element, a source of power for moving said rod, and an electromagnet serving to hold the rod at any position to which it may have been moved by the source of power.

664,992 Trolley for electric railways, L. d'Orville Chabut, Pittsburgh, Pa.

665,027 Printing telegraph; H. Mahnken, New York, N. Y.

665,040 Automatic fire-alarm; A. R. Thompson, Indianapolis, Ind.

665,051 Electric traction; S. G. Bennett, Wolverhampton, England.

665,064 Electrolytic cell; E. D. Chaplin, Winchester, Mass.

665,087 Controller for electric motors; F. W. Garrett, Johnstown, Pa.—A switch-handle, a guard-plate adjacent to said handle, and means for bringing together and separating the handle and plate, said handle and plate being so arranged relatively that, when brought together, the handle can not be grasped for practical operation.

665,094 Means for electrical car propulsion; J. H. Hertner, Cleveland, Ohio.

665,127 Controller for electric motors; G. H. Parmelee, Johnstown, Pa.—Two rotary switches and an operating handle for each switch, means for preventing operative access to the handle of one switch unless the other switch is in a predetermined position.

665,133 Electrical valve controller; C. B. Riggs, New Rochelle, N. Y.

665,134 Telegraph or telephone call mechanism; E. E. Salisbury, Chicago, Ill.

665,139 Control of electric motors; B. C. Shipman, Johnstown, Pa.

665,143 Control of electric motors; E. W. Stull, Johnstown, Pa.—Consists of a master-controller, a submaster controller governed by the master-controller, and a motor-controller governed by the submaster-controller.

665,144 Controller for electric motors; E. W. Stull, Johnstown, Pa.

665,156 Double-pole switch; R. E. Wood, Baltimore, Md.

665,186 Electric shuttle motion for looms; J. M. Cryer, Poulton-le-Fylde, England.

665,195 Storage battery; A. G. Eneas, Boston, Mass.

665,248 System of electric traction; L. M. Maxham, Boston, Mass.

665,251 Mouthpiece for telephone-transmitters; W. S. Moore, Indianapolis, Ind.

665,266 Process of manufacturing gas; F. Purdy, Chicago, Ill.

665,305 Electrical transformer; A. F. Berry, London, England.

665,318 Electric motor controller; F. W. Garrett, Johnstown, Pa.

665,319 Alarm device for armature shafts; F. W. Garrett, Johnstown, Pa.

665,320 Controller for electric motors; F. W. Garrett, Johnstown, Pa.

665,321 Method of controlling electric motors; F. W. Garrett, Johnstown, Pa.

665,322 Safety device for electric motor controllers; F. W. Garrett, Johnstown, Pa.

665,324 Means for controlling electric motors; John Green, Johnstown, Pa.

665,337 Electric railway motor; F. A. Merrick, Johnstown, Pa.—A horizontally-divided field-magnet frame, having openings at its ends, end pieces fitted to the said openings and carrying the armature-shaft bearings, and securing-bolts engaging projections on both the frame sections and also on said end pieces.

665,350 Electric motor control; B. C. Shipman, Johnstown, Pa.

665,352 Electric fuse-box; E. W. Stull, Johnstown, Pa.

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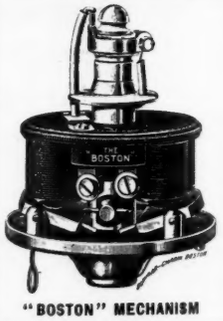

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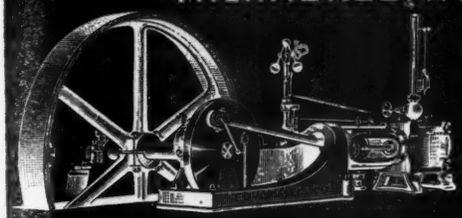

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The Ball & Wood High-Speed Engine

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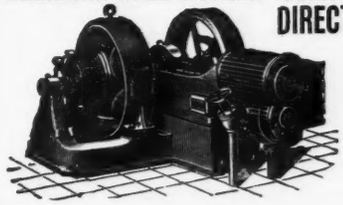

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We furnish complete equipments, consisting of engines, generators and motors of our own manufacture.

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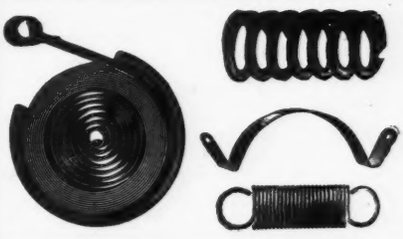

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3—60 Kw. "
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4—40-light, 2,000 C.-P., T.-H., M.-D. Arc Dynamos, ring armatures, self-oiling bearings.

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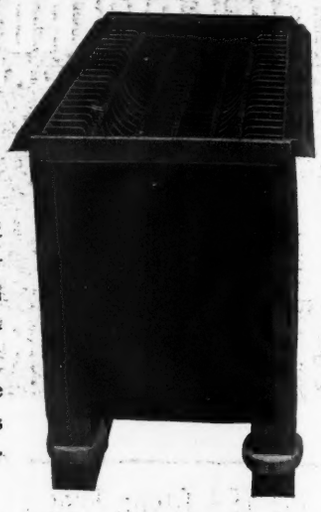
Batteries



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Gould Batteries give greater efficiency for less weight than any other battery.

Gould Batteries are especially adapted, beyond other systems, for electromobiles, and for central station lighting and power, electric elevators, railroad signal apparatus, telegraph, telephones, electric fire alarms.

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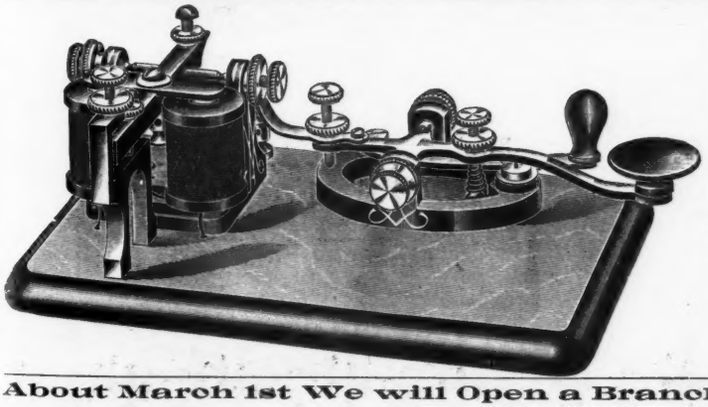

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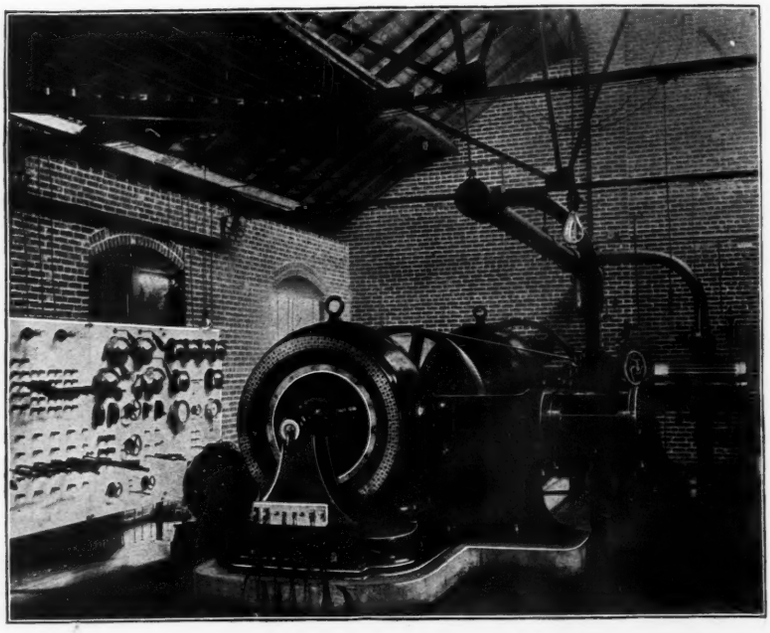

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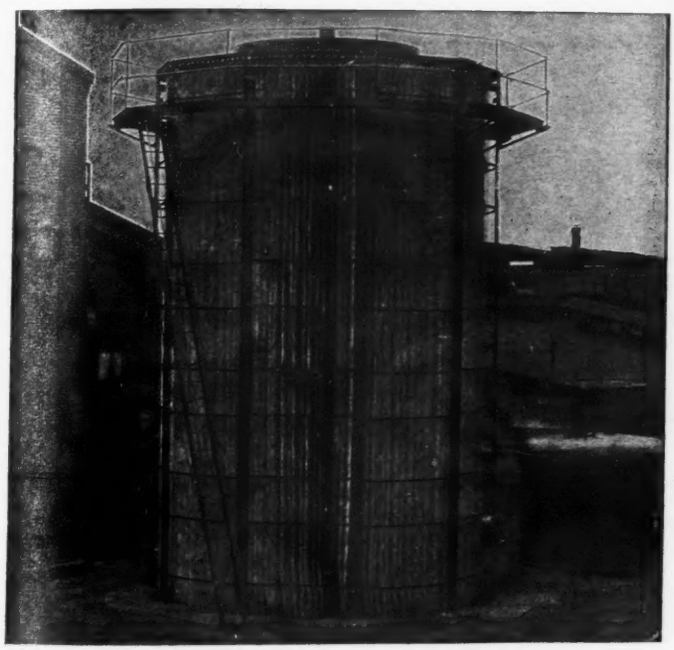

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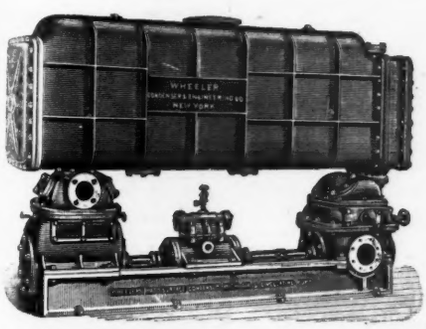

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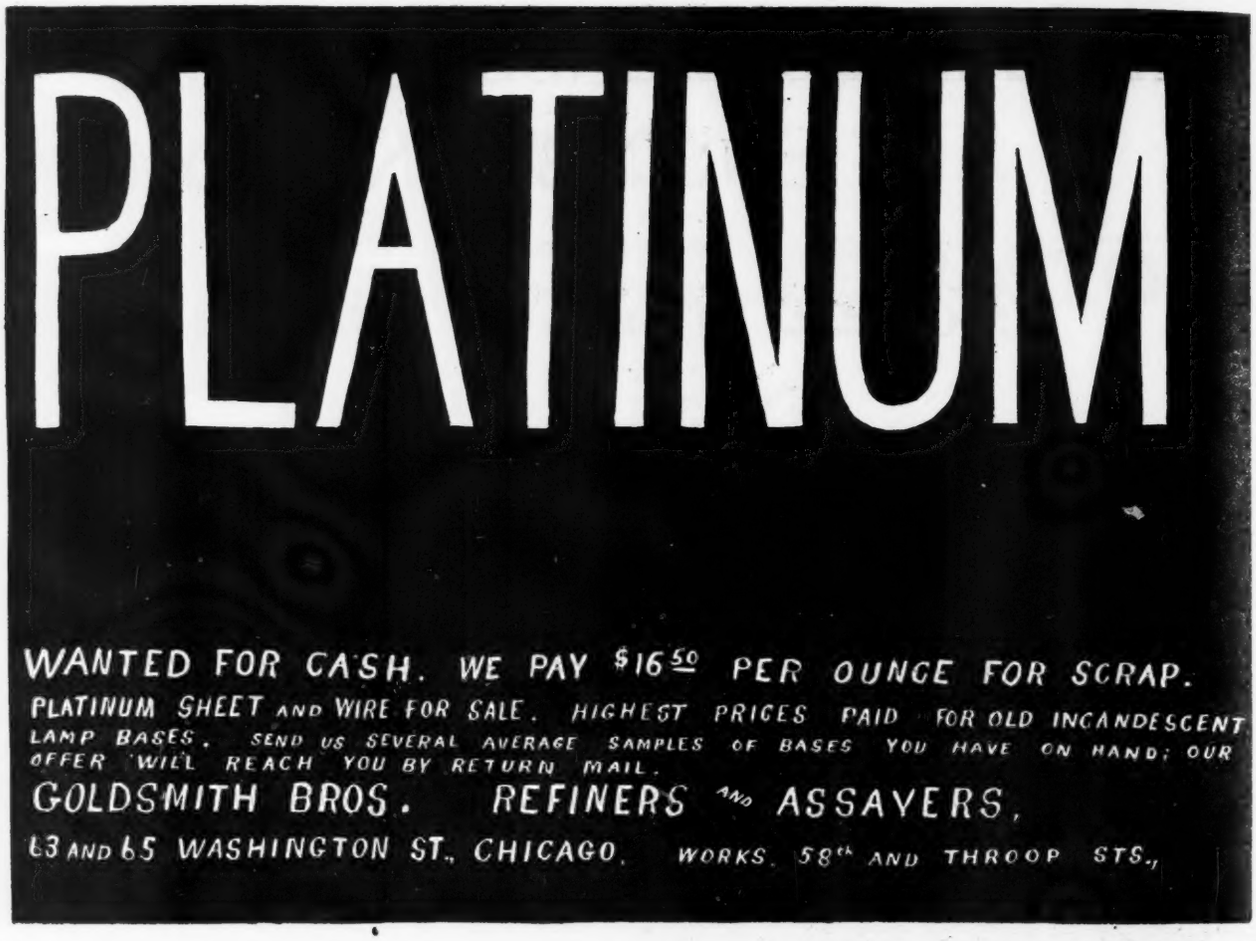
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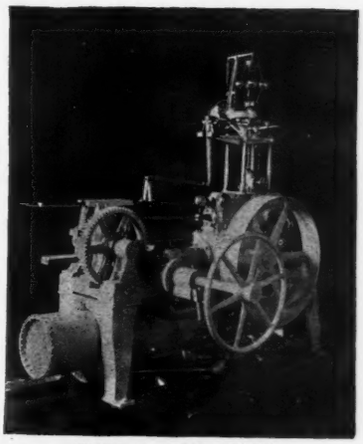

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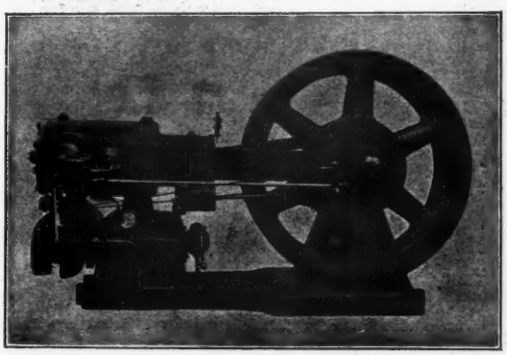

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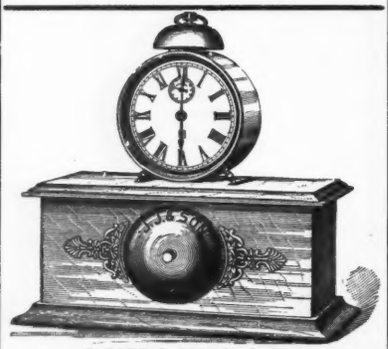

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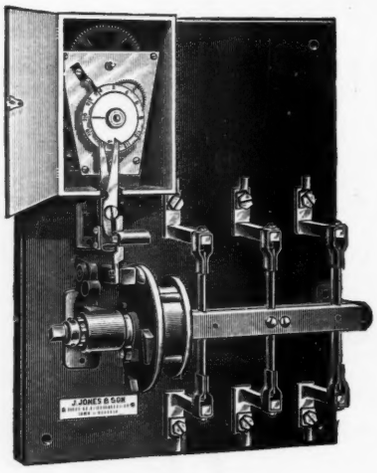

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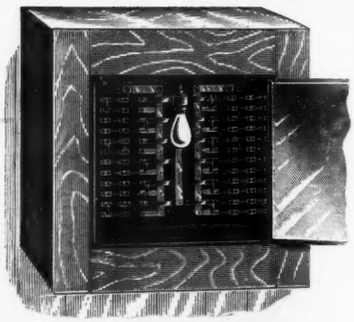

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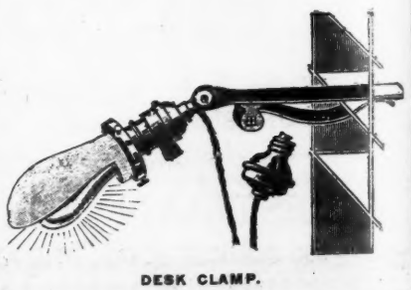

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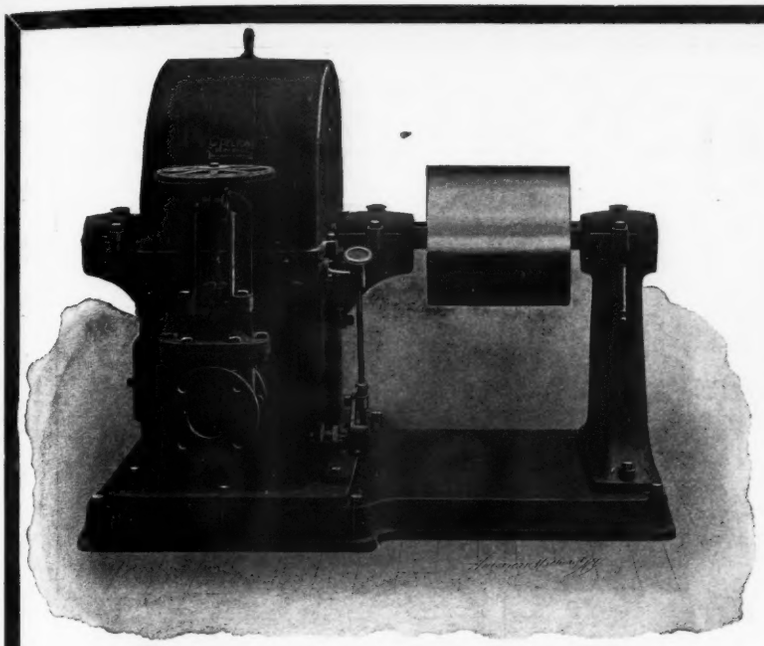

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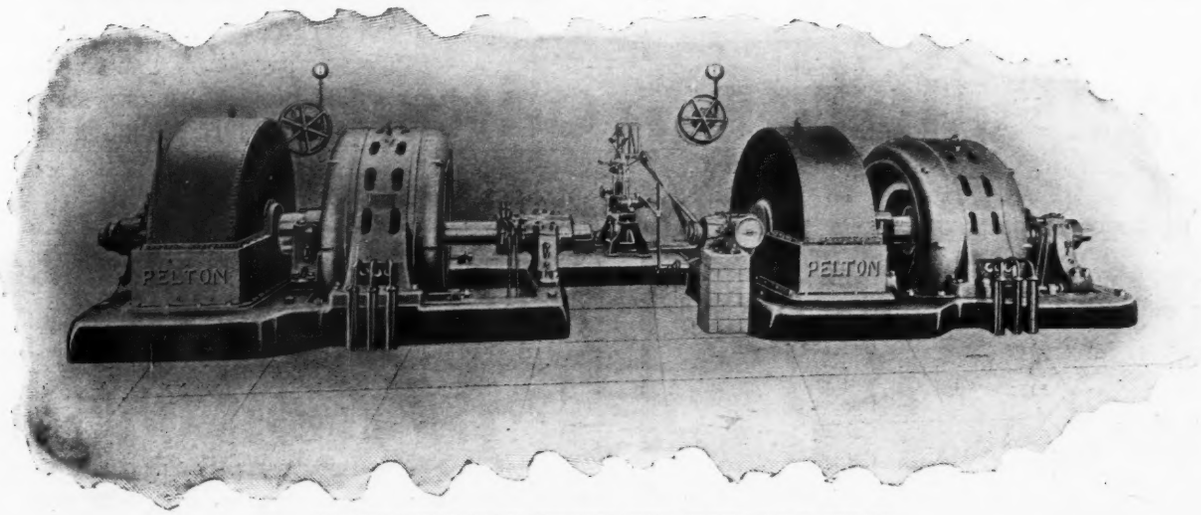

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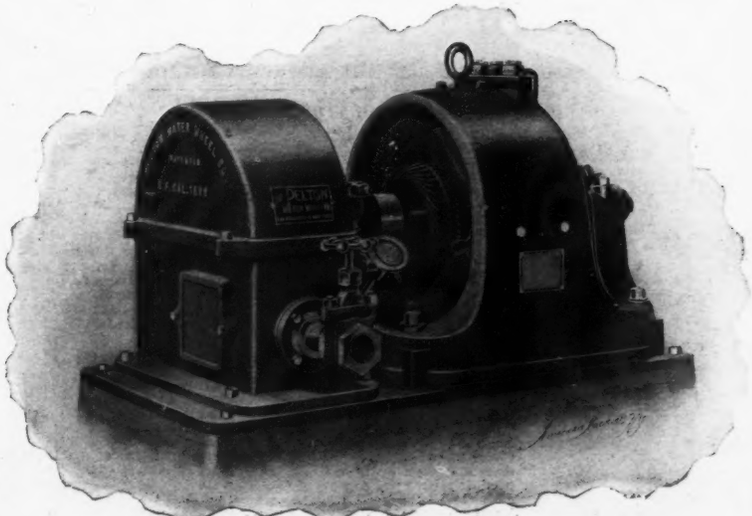

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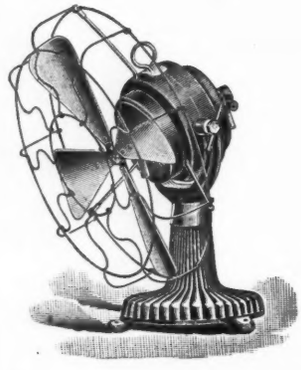

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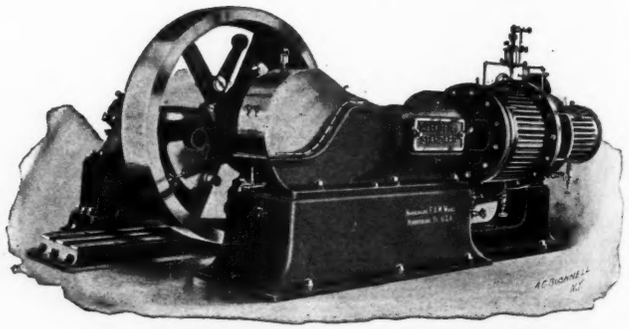

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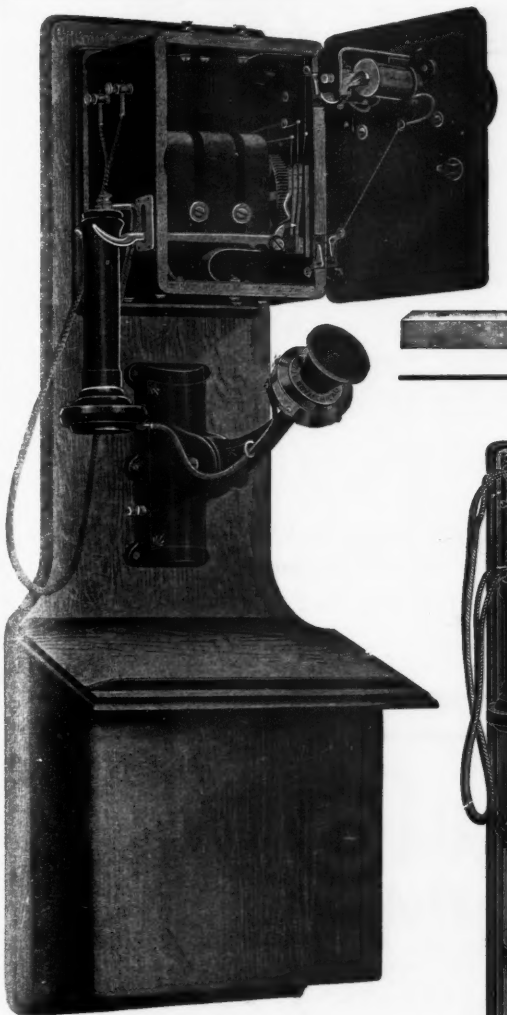

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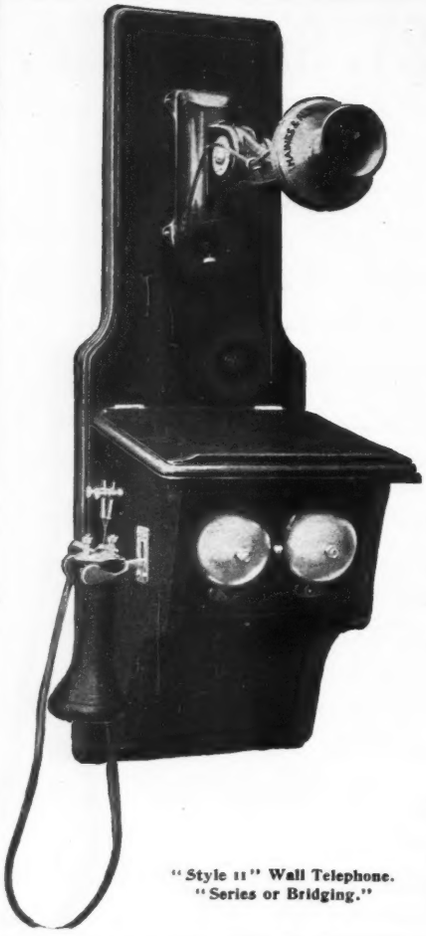

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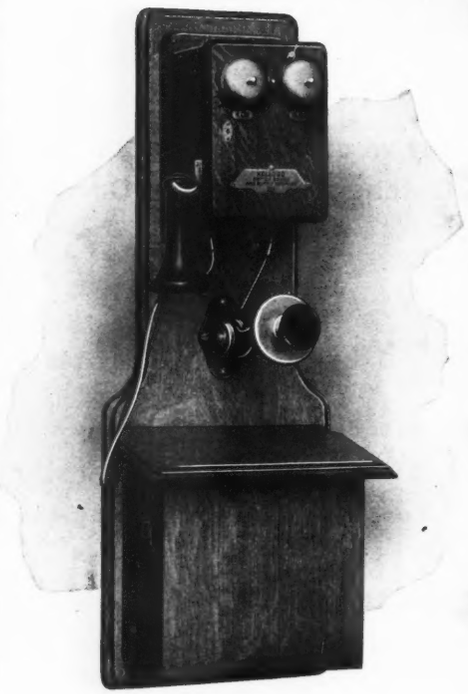

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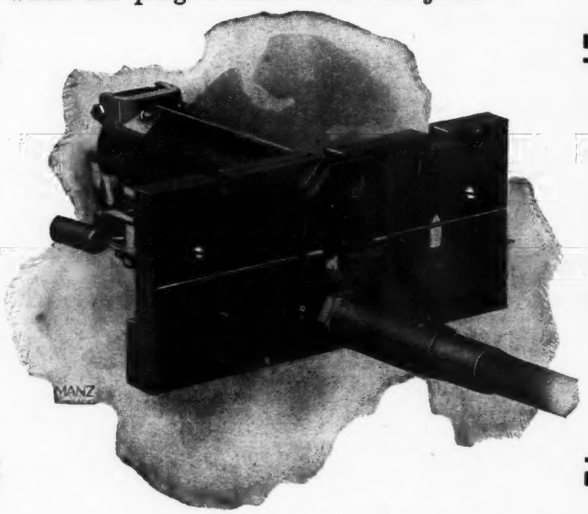

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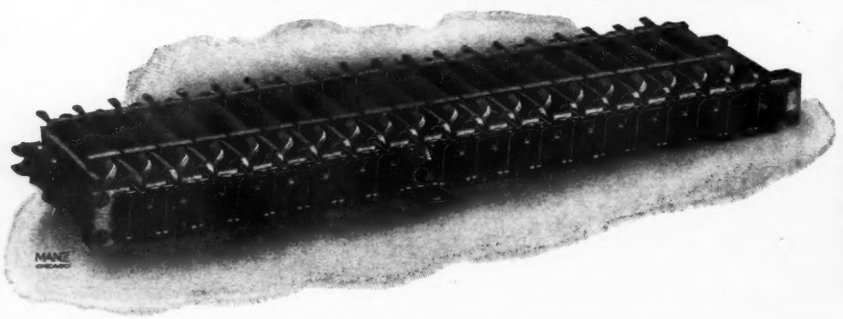

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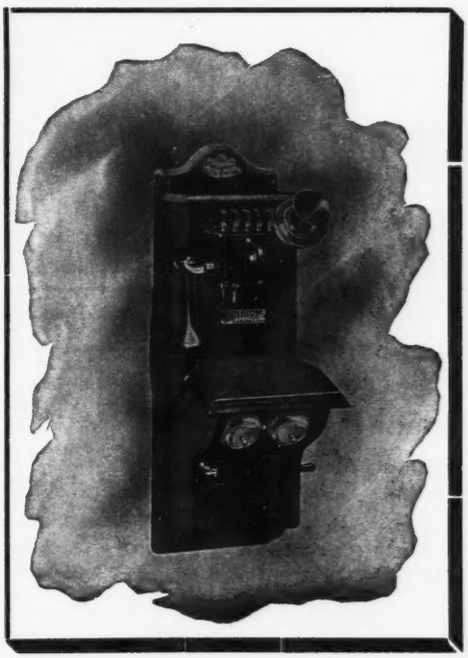

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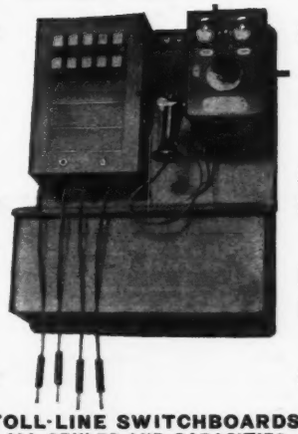

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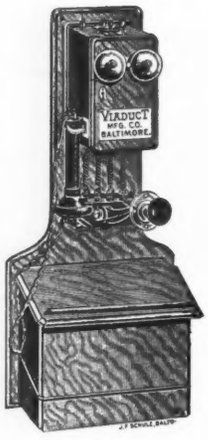

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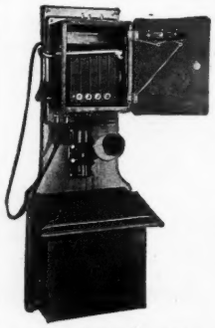

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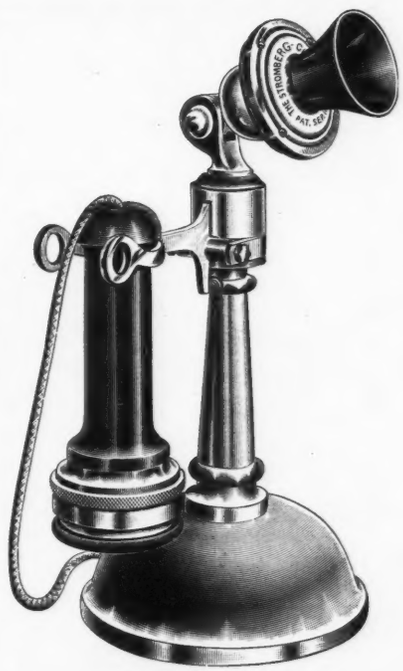

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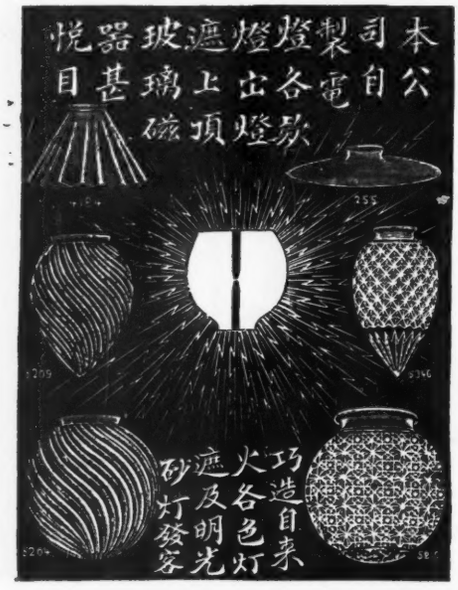

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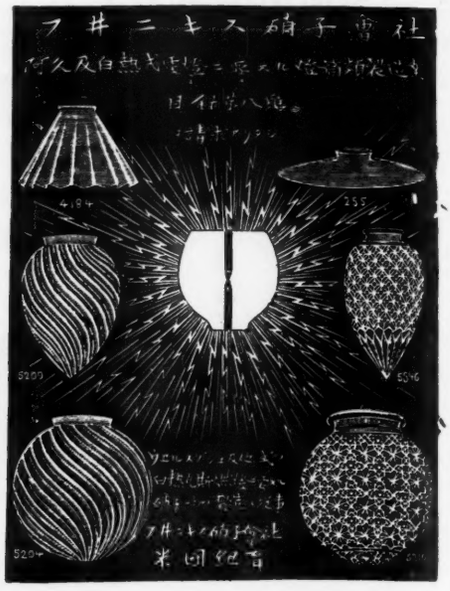

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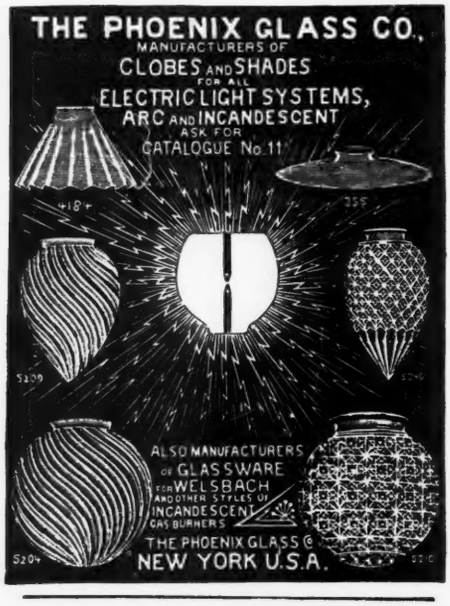

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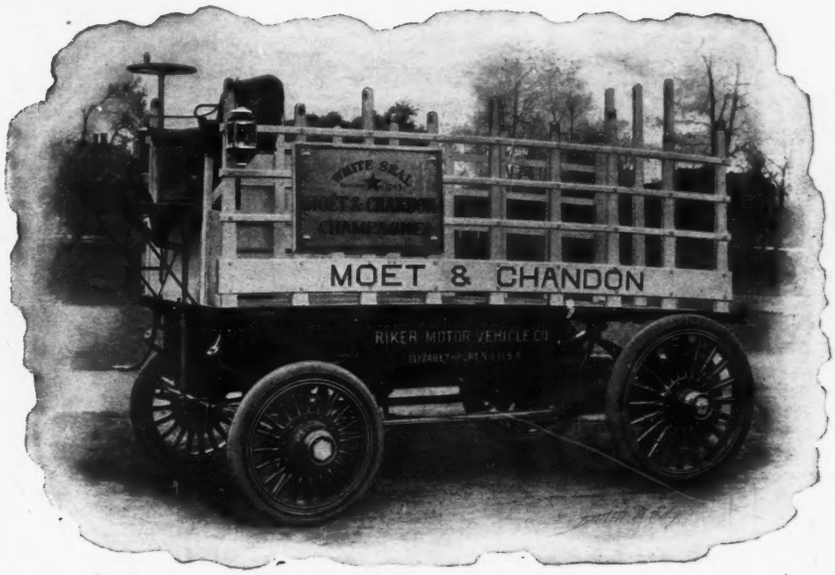

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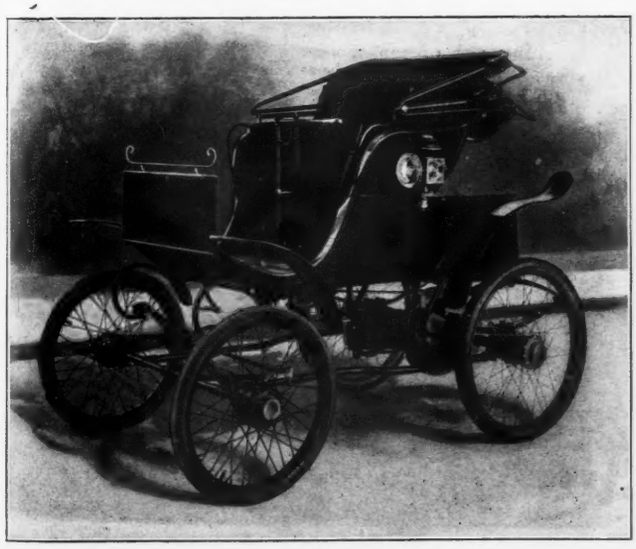

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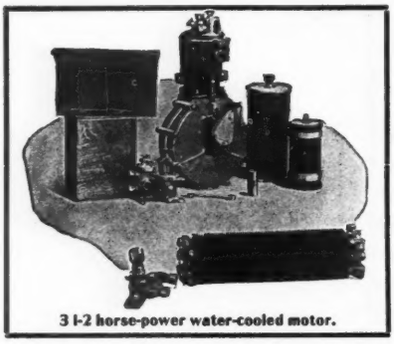

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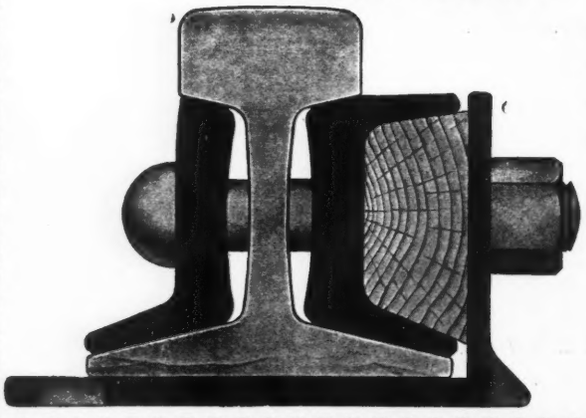

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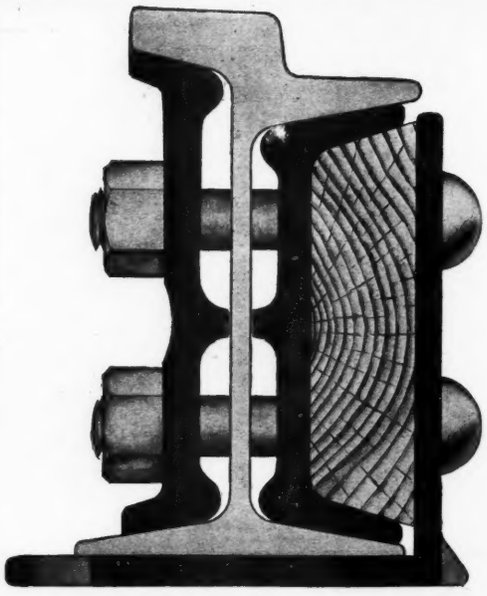

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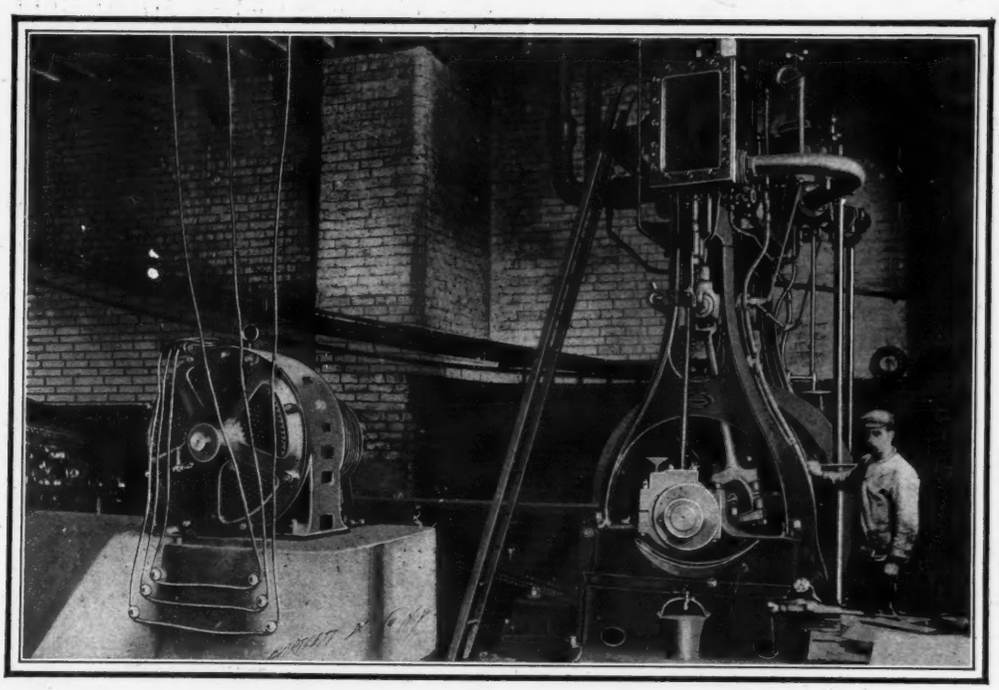

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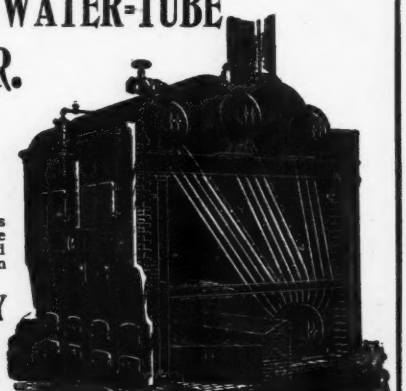

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